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ABSTRACT

The book offers practical information for classroom teachers and teacher educators on effectively incorporating computer technology in the classroom. The book focuses on the change associated with the growing presence in educational institutions of the new communication and information processing technologies, which is most significant for language and literacy educators. The book is dedicated to the theme of literacy and the new technologies, with all the articles focusing on exploring the intimate connections between language and literacy practices and the uses of digital media and telecommunication technologies in educational settings. Articles in the book are: (1) "Using Information Technology in Language and Literacy Education: An Introduction" (Ilana Snyder); (2) "Integrating Computers into the Literacy Curriculum: More Difficult Than We First Imagined" (Ilana Snyder); (3) "Reflections on Research in Computers and Composition Studies at the Century's End" (Gail Hawisher and Cynthia Selfe); (4) "Reading and Writing the Internet" (Phil Moore); (5) "Everything Is Connected: An Information Technology Program Comes Together" (John Travers); (6) "Making Moves with Information Technology: An Information Technology Centre Works Closely with the Resource Centre in a Small School" (Wendy Edwards); (7) "Nasties on the Net: Media Hype or Major Concerns for Schools?" (Ken Dillon); (8) "One Small Step..." (Vivienne Hand); (9) "CD-ROMs as an Information Source" (Lesley Russell); (10) "Conversations with Teachers: Talking with Lorraine Hook"; and (11) "Conversations with Teachers: Talking with Judy Simms." (CR)

Information Technology

A Collection of Articles From the Australian Literacy Educators' Association

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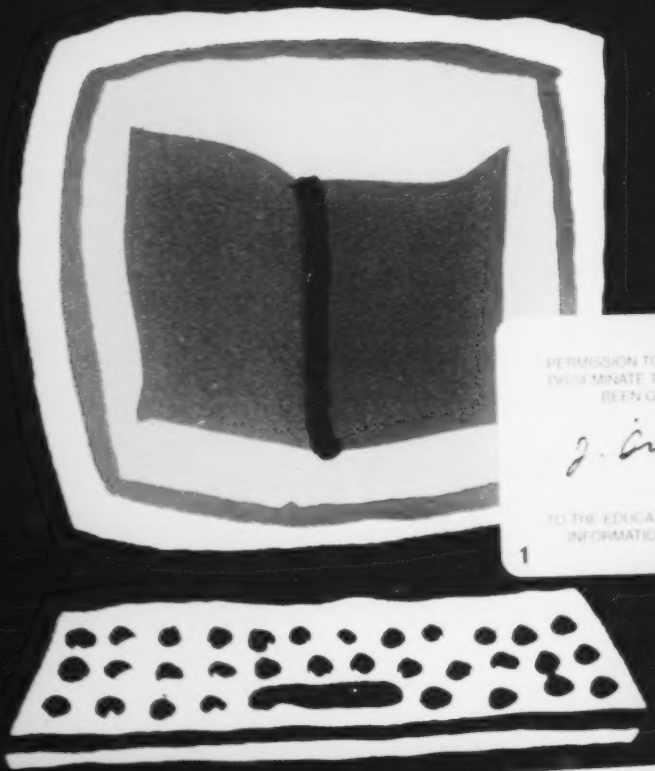

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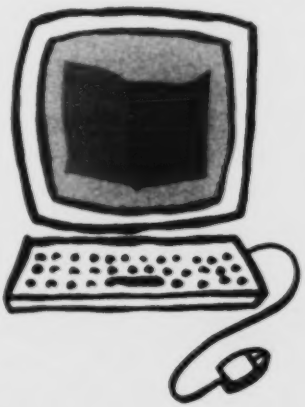
Teaching Literacy Using Information Technology

A Collection of Articles From the Australian Literacy Educators' Association

Joelie Hancock, Editor
The Flinders University of South Australia
Adelaide, South Australia, Australia

International Reading Association
800 Barksdale Road, PO Box 8139
Newark, Delaware 19714-8139, USA
www.reading.org

Australian Literacy Educators' Association
Box 78
Carlton South
Victoria 3053
Australia



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Contributors

Editor

Joelie Hancock
Senior Lecturer in Education
School of Education
The Flinders University of South Australia
Adelaide, South Australia, Australia

Authors

Ken Dillon
Senior Lecturer in Teacher Librarianship
School of Information Studies
Charles Sturt University
Wagga Wagga, New South Wales, Australia

Wendy Edwards
Teacher-Librarian
St. George College
Torrensville, South Australia, Australia

Vivienne Hand
Deputy Principal
St. Peter's Glenelg Anglican Grammar School
Glenelg, South Australia, Australia

Gail Hawisher
Professor of English and Director of the Center for Writing Studies
University of Illinois at Urbana-Champaign
Urbana, Illinois, USA

Lorraine Hook
Teacher-Librarian and Information Technology Coordinator
Mitcham Primary School
Kingswood, South Australia, Australia

Phil Moore
Product Manager
British Telecom CampusWorld
Slip End, South Bedsford, United Kingdom

Lesley Russell
Information Technology Coordinator
Scotch College Junior School
Torrens Park, South Australia, Australia

Cynthia Selfe
Head of Humanities Department
Michigan Technological University
Houghton, Michigan, USA

Judy Simms
Course Development Officer
Materials Unit
Open Access College
Marden, South Australia, Australia

Ilana Snyder
Senior Lecturer
Faculty of Education
Monash University
Clayton, Victoria, Australia

John Travers
Principal
Mitcham School
Kingswood, South Australia, Australia

Using Information Technology in Language and Literacy Education: An Introduction

Ilana Snyder

We live in times marked by increasingly rapid and profound change. Cultural theorists such as Stuart Hall (1996) use the term "New Times" to refer to the social, economic, political, and cultural changes which characterise the present. There is no escape from the impact of these changes because they shape the material and cultural conditions in which we live. Our responsibility as educators is to understand the distinctive features of these new times and to respond to them ethically and effectively in the ways in which we engage in our professional work.

This book focuses on the change associated with these new times, which has, perhaps, the most significance for language and literacy educators—the growing presence in educational institutions of the new communication and information processing technologies. Whether the technology is word processing, electronic mail, or CD-ROMs, the use of these technologies alters how language, both verbal and visual, is produced, distributed, accessed, and understood. The application of these technologies influences the generation, manipulation, revision, storage, and retrieval of texts as well as the end products. These products may be anything from a printed paper document to a hypertext web that exists only in electronic form.

Closely associated with the use of electronic communication and information technologies in educational settings is the emergence of new literacy practices (Snyder, 1997). We know that the use of the new technologies affects how we read and write, how we teach reading and writing, and how we define literacy practices. We also know that, increasingly, language and literacy teachers at all levels of education are using these technologies for teaching, research, and professional development. Accompanying this growing use is the .ecognition that we are faced by new questions and challenges related to both theory and practice. These questions and challenges provide the central focus of this book.

Examination of the complex issues associated with the use of the new technologies, however, is not without difficulty. Discussions about their social, cultural, and educational influences have often been clouded by hype: technology is presented as a panacea; enhanced communication is guaranteed if technology is used; connections are drawn between technology, freedom, empowerment of the oppressed, and democratisation (Snyder, 1996). But cynicism about the technologies' so-called powers also abounds: the technologies are dismissed as simply new instructional and communication tools; they are rejected as yet another form of social control, promoting the interests of state and corporate sectors (Birkerts, 1994).

Clearly, polarised responses, whether they exult or condemn the technologies' powers, are limited and limiting, and the need to move beyond them is becoming increasingly urgent. Instead of either celebrating or demonising the technologies, it is more productive to further understand them to exploit their educational possibilities. Above all, it is important to look critically at assertions that the technologies in and of themselves will either radically transform or diminish the social interactions that are intrinsic to effective teaching and learning.

At this point in the short history of our engagement as a profession with the new technologies, it is comforting to note that

we seem to be moving beyond the limitations of polarised responses to their use. Disappearing are the days of either uncritical enthusiasm or blanket repudiation as the only legitimate reactions to technological change. We recognise that technology is composed of both good and bad and of both generative and repressive influences. Indeed, Foucault's (1979) notion that all our explanations of power and the technologies of power are necessarily partial—neither wholly good nor wholly evil—is clearly a more useful frame within which to examine the technologies and their influences.

It is also increasingly apparent that we are fast approaching the moment when literacy and computers will no longer be perceived as separate technologies, but rather as "ineluctably intertwined" (Aronowitz, 1992, p. 133) and interdependent. We now understand that literacy and technology are integrally related. Literacy is necessarily defined in relation to available technologies—so much so that literacy itself might be best understood in terms of a fundamental relationship between language and technology (Lankshear et al., 1997).

As educators, it is our responsibility to assess critically how we can integrate these versatile and volatile technologies into our teaching and research practices with pragmatism and imagination while retaining a sceptical perspective. However, critically examining the implications of the use of these technologies for our pedagogy and practice is only part of the challenge. As language and literacy educators, we must also consider their impact beyond the walls of our classrooms and the boundaries of our educational systems. We simply cannot afford to ignore the fact that our culture has begun to go through what promises to be a metamorphosis. Moreover, the escalation of the rate of change is so dramatic that it may be that the possibility of evolutionary accommodation has been rendered impossible. Although all the chapters in this book focus specifically on the field of technology

and literacy in educational settings, it is within this broader cultural context that our work and thinking must be located.

The entire book is dedicated to the theme of literacy and the new technologies: All the chapters focus on exploring the intimate connections between language and literacy practices and the uses of digital media and telecommunication technologies in educational settings. The chapters represent authors from Australia, the United States, and the United Kingdom. Together, they account for some of what we already know in this field and suggest what we have still to discover.

In the first chapter, which focuses on teachers, technology, and change, I present the findings of a follow-up study to an earlier investigation of the use of laptop computers for literacy purposes in Years 6 and 7 in a private coeducational school in an Australian city. The initial 2-year study found, amongst other things, that the computers were used for writing in minimal ways. Interviews with the participating teachers 2 years after the study ended revealed that the use of computers still remained marginal to the English curriculum and to classroom writing practices. I consider the teachers' responses to a curriculum innovation in the light of Cuban's (1986) theory of incremental change.

The second chapter is by Gail Hawisher and Cynthia Selfe, the editors of *Computers and Composition: An International Journal for Teachers of Writing*. Gail and Cynthia have pioneered computers and writing as a legitimate and respected research field and have been instrumental in provoking the members of this teaching and research community to take understandings into new territories. In their chapter, they examine the history of the field of literacy and technology studies, a field complicated by political, social, and cultural articulations. Their critical overview of research in these new electronic spaces provides a richly detailed map in which to situate the chapters that follow.

The Internet is the focus of Phil Moore's chapter. Some readers will be familiar with his prescient book, *Using Computers in*

English: A Practical Guide, published in 1986. An English teacher and consultant for 16 years, Phil now works for British Telecom as product manager of BT CampusWorld, the United Kingdom's leading Internet-based education site. In his chapter, Phil takes us on a journey of exploration of these new virtual worlds. He considers the characteristics of the Internet, the kinds of texts its use encourages, and how it can be exploited productively as both a resource and as a site for the practice of critical literacy in our classrooms.

Integrating information technology (IT) into the curriculum of a primary school in South Australia is the focus of John Travers's chapter. Mitcham Primary introduced computers in 1981, yet Travers confesses that clear curriculum benefits have only recently emerged. In a reflective appraisal of the project, Travers argues that it has been a large, expensive, and long-term experiment but one with ongoing exciting possibilities. Effective use of the new technologies is closely connected to skilled teachers and students, good software, printers that work, as well as many other factors. Travers identifies some of the key elements fundamental to the establishment of a strong IT program. These include teacher proficiency, an emphasis on basic computer competencies, careful selection of software and the development of skills required to use it effectively, up-to-date equipment that is part of powerful networked systems, and above all else, curriculum imagination. When all these interdependent elements are available, schools may use the technologies to support the goal of developing independent and resourceful learners.

In the next chapter, Wendy Edwards, the teacher-librarian in charge of the resource centre at St. George College, a small Greek Orthodox K–8 school in Australia, discusses her contribution to increasing students' understanding and use of IT. Edwards achieved this positive outcome by establishing an information technology centre that worked closely with the resource centre. She built a collection of reference CD-ROMs and supported teach-

ers in their use of IT, including CD-ROMs, computer applications, and software. The success of the project is in part attributed to the connection between the IT centre and the resource centre and efforts to use the technologies in all curriculum areas.

In "Nasties on the Net," Ken Dillon, a lecturer in Teacher Librarianship Studies at Charles Sturt University, New South Wales, asks whether schools should consider the use of filters or other mechanisms to limit students' access to the Internet. Dillon invites readers to look critically at the media hype that often depicts the Internet as a hotbed of unsavoury material. The teacher-librarian, as the school's information expert, Dillon argues, has an important role to play in the careful consideration of such matters as well as in providing leadership in facilitating access to and effective use of the Internet for all the members of the "information literate school community."

Dillon outlines a number of different techniques for managing student access to the Internet. These include organisational arrangements such as written agreements signed by students, parents, and teachers outlining the terms and conditions of student-Internet use, and technological mechanisms most often in the form of filtering software.

Serving as both a teacher-librarian and deputy principal of a private primary school in South Australia, Vivienne Hand records in her chapter how innovation and teacher change can be managed effectively. Central to her story are the initial tentative steps that involved the purchase of a computer with CD-ROM facility and information-rich CD titles for student use, all located in the library. Once the hardware and software were acquired, attention was directed to creating an environment in which students were encouraged to play and explore with the technology. Hand argues that the teacher's role in helping students target relevant information is critical, but she also advises teachers to familiarise themselves with the content and structure of the software, to focus students on the tasks, and to be involved in the careful selection of

CD-ROMs. Above all, Hand stresses the importance of providing programs designed to help students gain information literacy and networking skills.

Before the school took what Hand describes as "a giant leap" in its IT program, it carefully investigated the present and future needs of its teachers and students in the area of IT. The school devised an IT policy that emphasised integration of IT into all key areas of learning, teacher support, ongoing professional development opportunities, appropriate resources, infrastructure, and adequate funding.

The final chapters include conversations with three educators about the use of IT in the classroom, with a particular emphasis on CD-ROMs. Lesley Russell, IT coordinator at Scotch College Junior School, Adelaide, focusses on the teachers and students at Scotch who have found that digital information has many advantages over books and journals. It is current, available to many at the same time, can be accessed at different locations, can be easily manipulated, and the students can read the texts in the order they choose. How students construct their own meaning from the texts they find on the CD-ROMs is the current focus of her thinking about the new literacy practices associated with the use of digital technologies.

Lorraine Hook is a teacher-librarian at Mitcham Primary School in Victoria, where John Travers (this volume) works. As coordinator of information technology, Hook uses CD-ROMs as the source of a different dimension of information to that offered in a printed text. She identifies some useful CD-ROMs and provides a number of insights into the differences between electronic and printed texts.

Judy Simms, a Years 1 and 2 teacher, has explored enthusiastically the ways in which she can incorporate IT into her pedagogy. She has approached the use of CD-ROMs systematically with clearly articulated objectives. Despite limited resources, Simms

points to a number of educational benefits derived from the use of CD-ROMs.

Together the chapters in this book offer different perspectives on ways in which the new electronic technologies can be used effectively by teachers, their students, and researchers. They also suggest how teachers can participate critically yet productively in computer-mediated literacy practices.

The publication of this book is timely. We simply cannot continue with our jobs largely as we always have, as if very little is really changing. We should think carefully before we dismiss the word processor as just a tool and a more efficient way of writing. We cannot continue to see networks and the World Wide Web merely as new ways for people to connect. Nor can we argue convincingly that books on disk are not that different from those in print simply because the words do not change.

Even if slower than in other social settings, the electronic revolution has begun to extend its reach into classrooms across the curriculum and at all levels of education. As literacy educators we need to come to understand the influences of these technologies and incorporate them into our teaching, if for no other reason than students are composing with them, using different writing processes, researching in new forums, and connecting thoughts in new ways. Further, we cannot ignore the importance of the relationship between practices in educational institutions and the larger material social practices of the real world of work and popular youth culture within a global information economy.

Yet, another compelling reason for critically informed classroom engagement with the tools of these new times relates to issues of power and how students gain access to it. Just as social, political, and economic power is closely associated with access to and knowledge of certain discourse forms (Gee, 1996), power now is associated closely also with access to and familiarity with the uses of the new technologies in educational settings. Students require opportunities to develop facility with and understanding

of the complex influences of these technologies. Facility and understanding enable students to interrogate the new reading and writing practices so that these practices do not become naturalised and thereby more difficult to subject to critical appraisal.

If we do not actively participate in the process of technologising the literacy curriculum, we risk not only marginalisation and limitations on resources, we allow people who are not literacy experts to make important decisions about reading and writing technologies. On the other hand, if we provide leadership in literacy and technology, we will be able to assume responsibility for changing the structure of our teaching and learning environments.

The choice seems clear. As language and literacy teachers, we should take a leadership role. Of course, taking an active part in determining the ways in which computer technologies are used in educational contexts may mean forming partnerships with people and groups not usually associated with the teaching of literacy. But if we form associations with other sections of educational communities based on trust, commitment, and open communication, then the potential for effective integration of electronic writing technologies into the curriculum may be realised.

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Integrating Computers Into the Literacy Curriculum: More Difficult Than We First Imagined

Ilana Snyder

In the opening chapter of his book *The Children's Machine*, Papert (1993) invites the reader to imagine a party of time travellers from an earlier century, among them a group of surgeons and another of school teachers, "each group eager to see how much things have changed in their profession a hundred years into the future" (p. 1). Papert contends that unlike the surgeons, who would be bewildered by the unfamiliar in the operating room of a modern hospital, the teachers would respond very differently to a modern school classroom. They might be puzzled by a few strange objects, but they would see the point of most of what was being attempted and could easily take over the class. Papert's parable is illuminating: The exponential growth of science and technology in recent years has meant that some areas of human activity have changed dramatically. Telecommunications, entertainment, and transportation as

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well as medicine are among them. But, argues Papert, "[s]chool is a notable example of an area that has not" (p. 2).

Of course, if we ignore the technology factor, we can observe important ways in which schools have altered in the modern era. As Cuban (1986) points out, governance, curricula, and school organisation have transformed substantially since last century. Although Cuban is writing about American schools, it seems reasonable to argue a similar case for Australia. But if we take technological impact into account, Papert's characterisation of schools is indeed poignant. New electronic technologies have not affected schools anywhere near to the same degree as other areas of human activity.

Technology has never assumed a significant presence in schools. When television arrived 50 years ago, many believed that the new communication medium would transform education. It didn't. When the first microcomputers appeared in schools in the late 1970s, similar predictions were touted about how they would metamorphose education. They have not. Amidst the rhetoric of state education ministers in Australia, who are promising that all schools will soon have an Internet connection and increasing numbers of students access to computers, history suggests that we should remain somewhat skeptical about the projected impact on pedagogical practices of the wiring of our schools. But, at the same time, we might also pause to consider whether there are ways in which these technologies might be employed for useful purposes in literacy education. Just because as literacy teachers we have remained largely impervious to technological change does not mean that this is how we should continue to respond.

In this article, I explore a manifestation of what is implicit in Papert's observation about teachers and technological change—that teachers appear resistant or at least reluctant to change when compared to people working in other social institutions. I look specifically at how a group of English teachers responded to an

opportunity to initiate changes in their classroom literacy practices with the introduction of computers. I have discussed the findings of the original study in a number of publications (Snyder, 1994a, 1995); this article concentrates on the follow-up interviews with the participating teachers 2 years later. Overall, it should provide some comfort for English teachers who are finding it difficult to adjust to growing school and parental expectations that they use the new electronic technologies in the context of language and literacy education. But before I discuss in detail what I found this time, I present a brief overview of the earlier study.

The First Study

The broad focus of the 2-year study was the complex networks of interactions between computers and the social practices of classrooms (Greenleaf, 1992). In the study, I examined how introducing computer writing technologies into the writing practices of six classrooms in a coeducational P–12 private school in Melbourne, Australia, both influenced and was influenced by the social environment of the classroom. The particular focus of the research was the interrelationships between two key aspects of the classroom context and the use of computers in the teaching of writing: the teachers' attitudes toward computers and their abilities to see the potential uses of computers as elements of a writing curriculum.

In the first year, I observed one Grade 6 classroom. The focus extended in the second year to five Year 7 English classrooms into which the 27 Grade 6 students had progressed. One teacher was responsible for both the Grade 6 class and one of the Year 7 groups, so altogether there were five teachers and six classes involved in the study over the 2 years. The portraits of the five teachers and their classrooms that emerged from the study derived from all the sources of data gathered—observation notes, journals, interviews, and transcriptions of talk associated with computer writ-

ing. The patterns I observed were instructive, suggesting that the teachers' approaches to writing without computers, their computer experience and expertise, the nature and extent of the support they received, their understanding of the ways in which computers may be used effectively in the writing curriculum, all influenced how they introduced and approached the use of computers for writing. Overall, it was the teachers' disposition toward the writing technologies and the extent to which they could see the potential of computers in the writing curriculum that had the greatest impact on students' writing practices and the ways computers entered into that writing.

In all six classrooms, the students appropriated the writing practices established by the individual teachers. Each of the five teachers emphasised the importance of correctness in writing and the publishing capabilities of the technology so that it was used primarily for transcription and printing a "good copy." None of the teachers ever really examined the potential of the technology to make a greater impact on students' writing. None explored how the technology could be used effectively as an integral part of a computer-mediated writing pedagogy (Balestri, 1988). In essence, they saw computers as tools to help them do tasks more efficiently, as add-ons to English, not central to their practice. Their approach to the teaching of English altered very little in response to the introduction of the technology. Neither as individuals nor as a group did they examine the use of computers for literacy purposes from a curriculum perspective.

I concluded (Snyder, 1995) that it would probably be unrealistic to expect teachers who rarely teach writing to suddenly do so when a new writing tool becomes available. It would probably be even less realistic to expect teachers to maximise a technology that has the capability to enrich students' writing practices unless they have had time to learn about its potential through practical, personal experience. I predicted that Tom and Miranda would

continue to use the computers, Jane may, but it seemed unlikely that Diana and Kate would, at least in the immediate future.

The Second Study

Two years later, I returned to the research site to interview the teachers who had participated in the original study. All were still at the school teaching lower-secondary English except one, Miranda, who had resigned a year earlier to go overseas. It is important to note that of the four Year 7 teachers besides Tom, Miranda was the youngest and the most familiar and comfortable with the use of computers and had been the most successful in incorporating them into her teaching. The interviews with Tom, Jane, and Diana lasted about 30 minutes each. The interview with Kate was shorter, just under 10 minutes.

After I had analysed the interviews, I sent the teachers a draft of this article and asked them to comment on my representation of our conversations and evaluation of the curriculum initiative in which they had been involved. Although I contacted them several times to ask if they'd read the draft, I never received any formal feedback. When I dropped into the school several months later, Jane told me that she thought what I had said was accurate if not a little harsh. She believed that, considering the circumstances, the teachers had achieved more than I gave them credit for.

It is difficult to explain why the teachers did not respond to my request. One interpretation is that it came at the end of the school year and the teachers had reports, final assemblies, and meetings to contend with. A more paranoid interpretation is that they were fed up with the study and did not like what I had written. Probably both explanations have some truth to them. However, the most important point to make here is that the research report would have been strengthened by the teachers' responses to this article. The inclusion of their comments would have represented a form of triangulation highly desirable in qualitative research.

Notwithstanding, what follows is my analysis of the interview data. Rather than report and discuss the interviews as separate cases, I have organised the teachers' responses thematically under eight headings. The categories reflect more or less the main questions I asked, but there is some overlap. Although the headings may appear to be somewhat arbitrary, they provide a useful framework within which to discuss the interviews. Taken together, the teachers' perceptions highlight issues that have implications for school technology policy and English teachers' professional development in the area of electronic writing technologies.

Changes Since the Study Ended

Although I was not optimistic that much change to literacy practices would occur, I was surprised to see just how little had taken place. Diana, Jane, and Kate felt that the problems they faced 2 years earlier have persisted and that, if anything, they were now using the computers less for writing purposes. Diana was somewhat cynical about the school's foray into technology. In her view, wishing to be "at the forefront of what all the best schools were doing," the school had rushed in, not long before the initial study began, to outfit the school with computers. But as with all innovative measures, it wasn't properly researched and trialed and, as a consequence, a lot of time was wasted and perhaps a lot of money." She regarded as a poor decision the initial commitment to buying portables and then a move back to desktop computers in response to teachers' complaints about the persistent breakdown and general inconvenience of the rapidly superseded laptops. In Jane's view, decisions in regard to technology were often not well informed. She complained that members of staff were not presented with models of how other schools had responded to the demands put on them for technologising the curriculum. She also believes that the teachers' knowledge about the potential use of the technology was incidental and usually gleaned from the media rather than any school-initiated professional development pro-

gram. By contrast, Diana connected the lack of progress in English in regard to computers with the fact that Tom was not available to help teachers. Indeed, when reviewing what has happened since the study was completed, Tom confirmed that "computing has slipped a bit. It slipped in Grades 5 and 6 when I went to Years 7 and 8. And then when I went out of the 7s into the 8s, it slipped in the 7s. It really needs someone on it all the time."

The Responsibility for Introducing the Use of Computers

The question of which curriculum group should bear the responsibility and subsequent timetable sacrifice for introducing the use of computers presents a thorny problem for many schools. Diana explained that at the research site it had somehow fallen on the English Department—"perhaps something to do with the fact that the keyboard has letters on it." As acting head of English, she argued strongly at an academic meeting that "having one isolated period a week in a computer lab is just a waste of time." She also suggested that the first thing to be done when students come into the school is to test their skills. "We assume they all know nothing, and there are some of them who know everything. So we're wasting a lot of time with some of them. We need to devise a test to determine whether they know how to use a computer and what particular software they are familiar with and all that. Then we need to give an intense period of instruction on our system and the particular programs." Diana believes that learning how to use computers should not be the responsibility of English but that students should be taken out of "most regular classes for a consolidated period and given something worthwhile that they can practice and use until they understand." Diana also stressed the importance of an enthusiast within the school to drive the push toward technologisation. "Tom was tremendous as a catalyst for doing things, and he was always enthusiastic and that's really important. I think that in any area of curriculum, to get it off the ground and going, you have to have enthusiasm." At

the time when I conducted the interviews, school policy about introducing basic computer skills had still to be decided.

Technology Support Systems

The findings of the earlier study strongly endorsed the importance of technical support. When asked to reflect on the year of the study, Diana said that she "relied very much on Tom to teach us, to give us backup and support." She said that she found it "really frustrating with the breakdown of equipment, particularly the printer." Jane also emphasised how much she "valued" Tom "as an expert" who "was available whenever there was a problem." But Jane added that since the school had moved from the laptops to labs things were better. "You know you've got a computer for each student and that they worked most of the time. They were more reliable." Diana told me that student work was lost because the students did not save carefully or there was a fault with the machine and "very often the whole system would break down and they'd lose everything." She added that "the only good time we had was when we had Adam who was hired as a technician for awhile, and he was able to step in and fix things." Although there was an acute awareness among the teachers of the importance of technological support, it had not been provided as part of a coherent policy.

Formulating a Whole School Technology Policy

The school's decision to hire a computer consultancy firm to assess the school's needs and to devise policy mirrors an increasingly common practice in educational institutions. It represents a trend toward drawing on the resources and expertise of the corporate world to help make decisions about the future directions of schools. At the beginning of 1995, the school employed a consultancy firm to formulate an Information Technology Policy for its three campuses totalling more than 2,000 students. As the firm has no links or history with education, I raised the issue of

teachers' confidence in the company's capacity to be sensitive to the requirements of a school. Both Diana and Jane felt comfortable about using outside experts to solve the school's technology problems. Tom, who had first mooted the idea of consultants, explained that the school had given the company a list of what it wanted. He emphasised that the school wanted to retain control of the shape the proposal would assume. Intrinsic to the plan, said Tom, was the aim to network all three campuses, which involved the laying of optic fibre cables. The consultancy company had had experience in linking banks via local area networks.

The school committee that prepared the brief for the consultancy firm comprised a small group of men with computer interests and skills. They then consulted the staff through a questionnaire that asked teachers what they would like to see happen. The response rate varied from campus to campus: Springfield (where Tom now works) 100%; Sunnydale (the site of the study) 80%; Meadowland 20%. Tom explained that the poor response from Meadowland reflected the campus's generally negative attitude to technologising the curriculum. Jane, who thought the questionnaire a positive step, believes that the staff will "be overjoyed" that the "sort of hotchpotch and hit-and-miss affair" that has been their experience until now will be replaced by "something that's networked and someone to solve all the problems when they break down." It will be of interest to assess the impact of this policy formulated in conjunction with outsiders and whether the hopes of the teachers for coherence are met.

Implementing the Technology Policy

The transition from devising a policy to seeing it put into action can be a less than smooth process. For Tom, integral to the successful implementation of a school technology policy is compulsory staff training. When I reminded him that he had said this over 2 years ago and it was still to happen, he explained that because "they couldn't put everyone through, they offered to pay

for community courses for staff." Although only 30 percent of staff has taken up this offer, Tom believes that the people who have completed courses have come away with ideas, saying, "I should be using this software to do this terrific activity in my classroom."

Tom argues that staff training has to come first. He held up City Boys Grammar, another private school in Melbourne, as a school that got it right. "They went in, they made a decision from the Head to the Council, they passed it, and it was just put down. The staff was presented with technologisation as a fait accompli. The administration said, 'We're going to be implementing computers next year. We will give you 50% off a computer. You will all buy them. If you develop one curriculum unit which can be done better with computers, we'll give you a further 50% off.' They had only 5 out of 80 staff who were computer literate before that was done. They took them home, everyone wrote up units, and they've implemented it over a couple of years."

Tom explained that the staff at this other school has experienced a number of developmental stages. "They've gone through using it as a presentation tool to start with, to a productivity tool, to the second stage—to using it as a thinking tool. They have some interesting ideas: no paper in their printers, the kids supply their own paper. If kids put viruses on the computers, they charge them at commercial rates to reload them. Games are totally banned. They got some of the older staff who had been there a while fired up on computers and they've done a lot of the driving which has worked well."

When comparing it to his own school, he said that it worked when someone like him was in the classroom, which possibly helps explain his attitude: "We're going to have to put it on them now that this will be compulsory and, if you don't like it, go and work somewhere else."

Curriculu es are being discussed at the department level. The rule of thumb is that if it is better than using a pen and paper then go for it. Tom believes that English is definitely better using

computers: story writing, factual writing—"doesn't matter what it is." He continued, "Research, which counts in any subject, the writing element of it—word processing—is basically going to be 70% of your computer use anyway." He stressed the importance of compelling staff to participate. "It's like bringing in a new maths curriculum. We have to say this will be coming in as of this day. Everyone's going to be put through training. We've got enough people to do the training on site. There's enough of us to split them up around the labs and do it like that." But he also is committed to getting experts from outside to facilitate the move. "The aim is to try and get as many different people as we can so that when we set up the policy it will be really good." Tom believes that his tough policy will mean that some teachers will inevitably give up but there will also be an element that will "realise that it's happening in every school and that it's not going to go away."

Basically Tom was very positive, more so than 2 years earlier. "I'm positive because it's going to be done on a bigger scale. The school will have to look at coordinators with specific curriculum responsibilities. They'll have to look at technicians on every site. They'll have to look at how we communicate with central administration."

When asked whether he was confident that things would change, Tom's answer was "definitely." He stressed the point that there was a new principal who is committed to the changes. When asked if there were any discernible gender differences in staff response to the changing policies toward computers, Tom said there were not. In fact he thinks that women "find it easy to learn computers. For one, they come to the course with better keyboard skills and better fine motor control, which accelerates their learning how to manipulate them."

Technology Policy and the English Teachers

There is a widespread belief that of all curriculum areas, teachers working in English are least likely to use technology, that they

see computers as dehumanising and interfering with creative processes.

The teachers at this school, however, did not mention such views. According to Jane, the teachers feel that they are ignorant and that they must "be brought up to speed" and that "this must be part of the new policy." Jane said that some have gone off on their own initiative to take relevant courses, but that most English teachers believe that it is the responsibility of the school to develop a policy that "will support them." She argued that "it has to be mandatory. You just say everyone during this year will go off and learn so they will all be at a certain level of computer competency. Otherwise, no matter what policy you implement, if people aren't up to speed they won't use it. There has to be an emphasis on teachers using it as an everyday tool."

Jane gave the example of another major private school using computers for reporting purposes, a task that got everybody familiar with the technology. This proved to be an effective way to initiate them into computer-based management of their professional lives and needs. Indeed, according to Jane, it reinforces a growing recognition among the staff that using computers would be more efficient and time saving. She also pointed out that the presence of computers and printers at this other school in the staff room invited staff to use them. "If I had that sort of set up in the English staffroom, I'd use the computer and printer all the time."

Integrating Computers Into the English Curriculum

Formulating a technology policy and training the teachers is only part of the issue. Research has shown that simply giving students computers does not change much (Bangert-Drowns, 1993; Cochran-Smith, 1991; Hawisher, 1989; Snyder, 1993). Their introduction has to be accompanied by a carefully shaped pedagogy if their use is aimed to enhance writing processes, products, and classroom contexts (Kantrov, 1991; Snyder, 1994b). Diana remembered it as "very difficult" to integrate computers into the cur-

riculum "in a worthwhile way." She recalled "a lot of wasted time." She also pointed out her dependence on the expertise of students who were "very competent with the computers." Although she did not necessarily see this as a bad thing in an area in which "the kids tend to know more than the staff," she still felt "inadequate as a teacher" and that she "hadn't felt that for a long time." She attributed these negative feelings at least partly to the fact that she wasn't "given proper training and preparation to do the job" that she was expected to do. Like Diana, Jane also admitted to relying on "kids who are whizzes at computers and who can solve any problems and give the instructions."

According to Diana, just one computer lesson a week meant, "it was fragmented." She explained that the shift from class sets of laptops to labs meant that there was even less opportunity to use computers in the English curriculum. She said, "I think that we should have portable computers that kids can go and pick up and use whenever they need them and that they should be available at all times." She believes that "computers are tools; they're not precious and shouldn't be locked away." She expressed her frustration at the way things have developed, which was reinforced by the observation that increasing numbers of students were using computers at home for their writing. By contrast, Jane preferred the lab to the portables "because they're reliable." She saw the portables as time wasting and unreliable. However although she preferred the lab situation, mainly to reduce the inconvenience of flat batteries and time wasting, Jane had a vision of one computer for each student, their own laptops, and "disks that could be fed in here if they didn't have the facility at home. It would make computers used far more, they'd be used in every classroom, in every subject, and I think that's the sensible way to go."

According to Jane, in English, it has just happened "willy nilly" but "perhaps that's the way all new technology is introduced." Diana compared the introduction of computers into the curriculum to the introduction of film. "We had to learn how to teach

film, and it took a while to integrate it into the curriculum. But perhaps doing it that way at least we've understood what doesn't work and what we think will." Diana believes that the extent to which computers are integrated into the curriculum all comes down to "how comfortable the classroom teacher is with computers and what possibilities she sees." Her vision is of a classroom context in which the computers "are taken for granted." Diana said that while the use of computers was officially written into the English curriculum, it was only word processing, "so it was simply saying that certain assignments had to be done on computer." Diana would like to be using the Internet for discussion purposes. She also felt that the English subject association could be taking a greater role in helping teachers integrate computers into the curriculum. According to Diana, "technology is here to stay, and we can't run away from it. At a school like this, which believes it is training people to go out as leaders into the community, you have to prepare them."

Jane found integrating the use of computers into writing easiest at Victoria Certificate of Education level (Years 11 and 12 in Victoria). As the students are all using computers for their drafts in English, she was writing responses to the drafts on the disks. Her Year 7 students were writing letters to their contemporaries at one of the other campuses of the school. She told me that they at last had access to a laser printer: "It comes out looking so much nicer, and they've got Works and all that, and they can do all these other fonts and things. They like to play, and I think that encourages the reluctant readers and writers as they can put a little picture on it."

Similarly to Diana, Jane wants access to computers all the time. "The students would have the choice of how they wanted to work, on whatever they were doing. Drafting and all that sort of stuff would be so much easier." She also wanted technical support available all the time, arguing that if constant access with such support were available "then if it became everyday, I think everyone would ultimately move to it even if they were first of all re-

sistant." Jane did not believe that teachers had to "go away and be shown how to integrate them as tools. That just flows naturally from what you do anyway. Using computers affects how you produce things, it makes things quicker, and there are exciting things you can do with them. If you've got any imagination, I don't think you need to go away and be taught that."

Kate remembered the year of the study as "very frustrating." She emphasised the problems with the general set up and availability of the computers for English. "If it had been a hands-on thing and we'd all been working at the one time, it would have been a lot easier." Her ideal scenario included a "bank of computers in the English department" where the students could have access to them if they wanted to during class time. She acknowledged that the school had made courses available to staff but she said, "I find it very difficult to fit the time in, to be honest, and I can see that the students work so well with them anyway."

Home and School: The Gulf

Perhaps somewhat ironically, the acceptance of the centrality of electronic technologies to reading and writing practices is stronger outside schools than within, and by students more readily than their teachers. There is a discernible gulf between literacy practices outside and those within educational institutions (Green & Bigum, 1993). Diana asserted that the parents probably assumed "that more is being done than it is" in the area of literacy and technology. "Because they've got computers at home and the kids are using them there, probably very successfully, they're not worried." But on the other hand, she believes that there are also parents "who are a bit frightened too. Of course there are parents who actually use computers very effectively at work, but I don't know that this particular parent body does." Jane is also aware of what is going on in other schools and the rest of the world from watching programs such as *Hot Chips* on television. These shows have interested her particularly in the possibilities of the use of the Internet. She

spoke enthusiastically about the new librarian who is very keen on linking students to "all sorts of things."

Diana also pointed out that she sees examples on television of more exciting computer-related activities happening at other schools. She is acutely aware of the discrepancy between what the students have at home and what is available at school. "Some have got more advanced programs and things on their home computers." She liked the "immediacy" of the Internet and wanted to see it used in Years 1–10 rather than in VCE where the "requirements restrict what you can take off on." Although enthusiastic about the possibilities, Jane was also sensitive to the curriculum implications of such ventures. "You would have to be much less rigid in all the things that you set out to accomplish. If you used the Internet and your class just took off on something that was quite incidental to the central concern, then you'd have to be free to do it. You'd have to be flexible enough." More than ever, these teachers are aware of the growing gulf between home and school and, as the interviews indicate, they are thinking hard about what they can do to deal with this phenomenon.

Discussion

This article began with Papert's parable that highlights an important observation: Compared to other areas of human endeavour that have been transformed by technological advances, schools have not altered much. At first glance, Papert's observation seems applicable to the site investigated. If one used, as an albeit crude measure, the amount of time per week the teachers encouraged their students to use computers for writing in the context of the English classroom, there is little difference from the situation 2 years ago. Indeed, if anything, less time is devoted today to the use of the technology. However, I think this is a superficial reading of what has happened. The interviews with the teachers indicate that although the computers are used less, there

have been subtle shifts in attitude among the teachers suggesting that processes of change have at least been set in motion. It seems likely that when a technology policy is instituted in the school, these English teachers will be willing if not keen to implement it.

One way to look at what has happened in these classrooms is that the teachers "have responded to the insistent drumbeat for change in muted ways well fitted to the nature of classroom life" (Cuban, 1986, p. 104). Teachers have acquired the reputation of being reluctant to alter anything, but perhaps this represents a "mislabeling problem" (p. 105). It may be that we have attached to teachers a narrow definition of the word *change*. Policy makers and reformers looking for change often ask only whether the plans were implemented or not. If what happened in schools seems linked to what was intended, then they believe that real change has occurred. But intended change is only "a small part of the larger process by which schools adapt to new information, external pressures, and dozens of other unplanned events" (p. 105). Researchers should be asking more probing questions than those posed by reformers. If change is understood in a broader way, then there is some evidence that the teachers in this study have adapted by altering, even though only slightly, their programs and, perhaps more significantly, their beliefs.

Also relevant is the understanding that teachers, as part of their occupational culture, have built informal criteria for what will and will not work in their classrooms. The teachers in this study know that with problematic equipment, lack of technical support, and the absence of curriculum policy aimed at integrating the use of computers into classroom practices, it is unlikely that using the technology will be a productive and positive enterprise.

Yet despite the pragmatism that has restrained these teachers, the interviews reveal that over the 4 years since the study began, their attitudes have shifted, even if only slightly. As they react to a changing cultural and school context, marginal alterations in their attitudes can be identified. Thus it seems reasonable to predict that

changes in their practices in the context of literacy will gradually begin to develop.

What emerges from this study is the recognition that for those committed to change, like Tom, patience and understanding are essential. "Patience is needed for accepting that what is intended seldom materialises immediately, and understanding is required for working with the stable processes of change at work in districts, schools, and classrooms" (Cuban, 1986, p. 108). For them to use the technology more, teachers have to be convinced that teaching and learning literacy will be more effective after the introduction of computers. Any efforts to modify classroom practice need to be well informed. Teachers' repertoires, which are both resilient and efficient, have been shaped "by the crucible of experience and the culture of teaching" (p. 109). Policy makers need to understand that altering pedagogy requires a change in what teachers believe to work. Cuban (1986) suggests that those committed to change need to acknowledge "that both continuity and change are interwoven in the schooling process" (p. 109). To disentangle one from the other and attach positive or negative connotations is to misunderstand the nature of teaching and learning. We need to understand that traditional practices may be integral elements within a functioning social system and that they are unlikely to change simply because new practices are technologically possible. In reality, those teachers who adopt innovations must engage in a complex problem-solving process in which they integrate old practices and new goals (Rubin & Bruce, 1990, p. 256).

Although it is a safe bet that the degree to which schools incorporate computers into instructional practices will fall short of the dreams of enthusiasts (and of manufacturers, software developers, and publishers), at some level of adaptation computers are appearing in schools and are being used in classrooms. "If history is any guide...incremental change—infinitesimal to the reformer's critical eye—will be a stable, attenuated response to the external challenge" (Cuban, 1986, p. 107). From the perspective of the

reformer, such a muted response to computers could be labelled as a failure of technology, an improvement blocked by teachers. But from the perspective of veteran practitioners and policy makers, aware of the complexities of social institutions and modest in aspirations, "such slow and marginal changes appear as substantial, given the conflicting goals, limited resources, and organisational settings that constrain classrooms" (p. 107).

Finally, this study highlights the need for researchers to study phenomena for longer periods of time. When I returned to the research site 2 years after the data-collection period had ended, I found evidence of emerging adaptability. It will be interesting to return again in a few years to assess what has happened in the interim. Longitudinal studies in education are all too rare. We have to beware of pronouncements in the literature that an innovation, a program, or a direction had failed after studying the planned change for 6 months, a year, or perhaps two. Despite the pressures of research costs and producing publications, educational researchers must resist practices that reduce the credibility of educational researchers' findings. Time is crucial in identifying instances of change—they become more visible with its passage.

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Reflections on Research in Computers and Composition Studies at the Century's End

Gail Hawisher and Cynthia Selfe

Although computers can be found in great numbers in schools at every academic level, a good deal of controversy continues to accompany their entry into educational settings. On the one hand they are greeted as revolutionary tools that will cure the ills of outmoded educational approaches, and on the other they are viewed as expensive instructional delivery systems that have the potential to destroy the human element in education. Clearly both views are extreme. Yet, increasingly, the new technologies have become the focus for hotly contested social struggles, struggles characterised by complex economic, political, ideological, and historical issues.

Vying for position within such disputes are not only educators but also publishers, commercial hardware and software producers, parents, governments, and the telecommunications players of the corporate world. Given the number of contesting forces within the new electronic landscapes and the range of interests in connection with education and language, those of us working in the field of computers and composition are beginning to recognise

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just how dramatically the values of democratic education and literacy will be played out in the next few years. For these reasons, the history, the present, and the future of technology studies within educational contexts are important intellectual spaces for educators and students of technology to map.

Our article focusses on the need to explore the history of research in computers and composition studies in order to better understand the present and future of this rapidly changing discipline. Given the importance of this intellectual, cultural, and educational territory—given the challenges educators face in the coming century—these years at the century's end are an appropriate time for the profession to pause and recover its histories of the research in the field. What we aim to do here is to present a synopsis of the research in literacy and technology, which has preceded us, and then turn to some fruitful points of departure for literacy educators who teach with computers and who hope to contribute to educational change in positive ways. Our article attempts to historicise the research literature on the uses of word processing, electronic networks, and hypertext and hypermedia as they relate to writing and writing instruction.[1] Framed by the kinds of questions researchers pose for the study of computers and literacy education, the review also discusses the various research methodologies employed in that study. Each section concludes with an overview of the various findings that have emerged over the past several years. Next, we turn to the kinds of studies that we believe have the potential to support democratic educational goals and practices.

For over 15 years literacy educators have tried to assess the impact of the use of computers on student writers at every level of education. Technological changes since the first fully assembled microcomputers in 1977 sparked a spate of studies that now number well into the hundreds. One of the earliest, Richard Collier's study (1983) of four nursing students, set the stage for the kinds of questions that would drive subsequent research. Collier asked

how the use of a computer application (in this case, a mainframe text editor) would influence the student nurses' writing processes (in this case, revision) as well as the quality of the texts they produced. And although he saw no improvement in quality, he found that the writers he studied revised more and produced longer texts with word processing than with conventional tools. Since Collier's early study, educational researchers have continued to probe the relationship among writers and various kinds of computer applications, aiming much of the research at school-based writing often with an eye toward examining how the teaching of writing might benefit from the use of the new technologies. In recent years, moreover, researchers have extended their study to the newer technologies of electronic communication networks and hypertext and hypermedia. Yet despite the considerable attention research in computers and composition studies has received over the years, there have been few studies that look at how the use of computers affects students' interactions with the cultural context or learning environment in which students participate.[2] In other words, little systematic attention has been paid to the kinds of research that have the potential to inform fundamental changes in education—changes that must be realistically played out within current social, political, economic, and ideological contexts.

Studies in Word Processing

By far the most prolific area of research in computers and composition, studies in word processing continue to abound in the research literature. Since the early 1980s, writing researchers and teachers alike have wanted to know whether computers could be used in ways that improve students' writing abilities. Unfortunately, the question has often been framed too simplistically as, "What is the effect of computers on writing quality?" which attributes too much power to computers and too little to how writers or literacy teachers might use computers. Today the

quality question seems somewhat naive and beside the point; word processing has become the writing technology of choice in school and workplace settings. And, just as English professionals no longer ask whether typewriters improve students' writing, many regard the quality question in relation to word processing as wrong-headed as well. As word processing becomes increasingly accepted as essential for student and professional writers alike, other research questions need to be formulated. Yet a review of dissertation studies reveals that researchers are still asking whether the use of word processing will enhance writing abilities.

Studies in word processing can be divided into two categories: those that employ primarily quantitative methods of inquiry, and those that rely on qualitative techniques. The majority of studies are quantitative or comparative studies, with writers divided into experimental and control groups and the use of word processing the primary variable that distinguishes the groups. Questions driving the research include how word processing in combination with process-oriented teaching influences writers' processes—planning, drafting, revising, editing—and products—quality, syntax, length, and number of mechanical errors. Researchers have also been interested in whether students tend to enjoy writing at computers and whether the technology is more appropriate for one group of writers than another. Among the various groups of writers that have been studied are students at all levels, from first grade through graduate school, and professional writers, both technical and creative.

The results of the research are many and varied. Students report positive attitudes toward writing and word processing after working with computers; student writers often exhibit finished products that have fewer mechanical errors than those written with traditional tools; and many writers produce longer texts with word processing than with traditional methods (Hawisher, 1988). Conflicting results emerge around the variables of revision and writing quality. As many studies find an increase in revision as not,

and only a few studies claim that writing quality improves. In fact, regardless of which group of writers is the focus of the research and regardless of whether the research is school-based or otherwise, investigations of writing quality continue to yield conflicting results. (For a meta-analysis of word processing in writing instruction, readers will want to consult Bangert-Drowns, 1993.)

The qualitative research, both case studies and ethnographic research, asks somewhat different questions from the quantitative studies. Questions focus on how writers adapt their strategies to computer writing, on whether their composing habits change with the technology, and on how the introduction of computers influences the cultural context into which they are introduced. A general theme drawn from these studies is similar to one from the comparative studies; that is, a writer's or student's particular habits and strategies for composing take precedence over the influence of the computers. Writers bring their routines and patterns of writing with them. If they are not extensive revisers before word processing, they probably will not become extensive revisers with computers even when revision strategies are part of the instruction (Bridwell, Sirc, & Brooke, 1985). (It is interesting to speculate on how this might change in relation to the youngest students, some who are likely to have learned most of their writing processes on computers.)

The few ethnographic studies that have been conducted also contribute new knowledge that the comparative studies cannot reveal. They suggest that while students often do their paper-and-pencil writing silently and privately at their desks, writing at a computer in elementary school settings, for example, may in fact transform school-based writing from a private to public activity as students gather around the computers to read and talk about their writings (Dickinson, 1986). In seeking to elucidate the subtle influences of computers in social interactions among students and teachers, the qualitative research, both case studies and ethno-

graphies, suggests the importance of the cultural context in shaping writers' work and learning with word processing.

Research on Electronic Networks

A major difference between research aimed at word processing and the early research on the discourse of the nets, more accurately called electronic networked discourse, is its cross-disciplinary emphasis. Unlike studies of word processing, only a few studies on electronic networks have been conducted in writing classes. For a more complete picture, English professionals must look at studies in distance education, communication research, linguistics, social psychology, and organisational behavior, to mention a few of the fields studying computer-mediated communication (e.g., Ferrara, Brunner, & Whittemore, 1991; Jones, 1995; Lea, 1993; Sproull & Kiesler, 1991; Mason & Kaye, 1989).

Since the research is cross-disciplinary, it is somewhat surprising that studies have converged on similar issues, asking similar research questions. The questions focus first on identifying the characteristics of electronic discourse, examining how participants respond to the discourse and then, for those working in educational settings, exploring its potential for teaching and learning. Many initial findings are more in the spirit of observations gleaned from experience in working with the medium, not unlike early exploratory studies in word processing. But regardless of whether the research is conducted within or outside educational settings, common questions, findings, and observations emerge.

Researchers agree that networked discourse employs a language that is somewhere on a continuum between spoken and written language. Indeed, researchers often refer to online communication as "talk" or "dialogue." Some participants write profusely on the networks; others seem terse, almost telegraphic. Conventions of language and style are still evolving and will change as the e-mail and conferencing programs become as easy

to use as word processing. A number of researchers have noted that a writer's relation to a screen and electronic communication seem different from a writer's relation to a written letter or memorandum. In writing to a screen, writers may at times lose the sense of an audience and, with that, the constraints and inhibitions that the imagined audience provides. At its most dramatic, this difference produces what has been termed "flaming," or emotionally laden, hurtful language inappropriate for classroom settings. Some researchers contend that the more focussed the task, the less likely flaming is to occur. In those studies where the electronic activity was goal-directed and the roles of participants clearly defined, no flaming was reported (Hartman, Neuwirth, Kiesler, Sproull, Cochran, Palmquist, & Zubrow, 1991).

Research in various fields, moreover, has suggested that the lack of paralinguistic cues such as one's appearance, tone of voice, and facial expression also invites participation on networks from those who normally refrain from speaking frequently in face-to-face contexts. Sensitivity to the position of individuals within organisations, corporate or academic, tends to silence those who perceive themselves as having lower status. A study by Dubrovsky and his colleagues (1991) looked specifically at electronic discussion in four-person groups with first-year college students and MBA graduate students; the researchers confirmed what they call "the equalisation phenomenon," that is, those with "lower status," the first-year college students, asserted themselves more and had greater influence on the group than the first-year college students in the face-to-face groups. Such studies can have important implications for literacy teachers who hope to encourage all students regardless of their class, race, or gender to participate; but the social science research needs to be scrutinised carefully before being imported directly into literacy classes (Eldred & Hawisher, 1995).

Basing their claims on similar research in the social sciences, literacy educators often argue that electronic discussion has the

potential to encourage students who are sometimes silenced because of their status to speak up, to participate electronically in ways that they avoid in traditional class settings (e.g., Barker & Kemp, 1990; Langston & Batson, 1990). As yet, however, no empirical research in educational settings has supported or contradicted such claims. It should be noted, though, that much of the social science research is conducted with participants who never meet face-to-face. For literacy teachers who primarily use electronic networks to supplement face-to-face class discussion, it is somewhat odd to foreground the network with its lack of social cues without acknowledging instructors' and students' many face-to-face interactions. (For a more complete early review of research on electronic networks, see Hawisher, 1992.)

Research on Hypertext and Hypermedia

Researchers in literacy studies have begun to explore the implications of hypertext and hypermedia for writing and writing instruction. One of the problems they encounter, however, is that hypermedia, like networked discourse, is essentially a new medium, existing only online. It takes many forms, and its instruction comprises only one of its many applications. And even when used for instruction the kinds of applications differ radically. Hypermedia programs can be assembled so as to mimic old computer-assisted instruction (CAI) programs with their workbook-like structure and dull exercises, or they can take an interactive form where individuals choose their own paths through online text with print, graphics, sound, and sometimes video as part of the text. Moreover, to borrow Michael Joyce's (1988) useful categories, hypertexts can be "exploratory" or "constructive," depending upon whether readers browse through a body of information already assembled or whether they write their own texts, transforming prior knowledge by acting upon what they read and write.

For educational settings, the early research on hypermedia environments exists primarily outside of literacy studies and often examines readers' and writers' navigational capabilities, that is, researchers look at how users move through large, complex nonlinear bodies of information without losing their sense of connection. Other questions driving the research focus on the design of hypertext systems and ask how material can be presented in such a way as to optimise learning. Researchers have also begun to ask whether particular kinds of pedagogical problems are more suited for some hypertext environments than for others. Rand Spiro and his colleagues (1990), for example, have designed a system on *Citizen Kane*, which is intended to foster advanced knowledge acquisition or learning beyond introductory material in any discipline. They base their approach in part on the notion that learners need not be subjected to the difficulties of navigating nonlinear and multidimensional textual environments for the acquisition of knowledge that could be obtained easily in other ways. Spiro's research suggests that certain hypertextual environments, in allowing instructors to represent knowledge in many different ways, can foster deeper understandings of difficult subject matter than traditional settings.

Another approach to using hypermedia environments in educational settings is to encourage students to author their own hypertexts and then to ask them to describe their experiences in working with the new medium. One exploratory study in a first-year writing class found that students responded generally favourably to reading and writing hypertexts (Kaplan & Moulthrop, 1991). While they sometimes wondered how they would know when they finished a reading assignment (there are no pages or specific paths to follow), they devoted large amounts of time and energy to reading and writing their own interactive fictions. In these kinds of hypertext environments, it is difficult to know where reading stops and writing begins since both occur in the same space often at the same time.

Researchers and teachers have only scratched the surface of hypertext and hypermedia both for the exciting opportunities and the possible dangers that they pose. There has been no research in literacy studies of which we are aware, that focusses, for example, exclusively on the hypertext environment of the World Wide Web (WWW). We would argue, however, that when hypermedia environments—either on the Web, in CD-ROM format, or in stand-alone applications—do no more than present information in lecture-like formats, they seem less promising than they might be. Yet if they are used in such a way as to allow readers and writers to make their own connections (with a speed, we note, that is unknown in print contexts) and then to create new knowledge based on these connections, they suggest a new instructional medium that we have only begun to imagine, much less study.

Cultural Theories, Critical Pedagogy, Feminism, and Technology

Each of the technologies discussed so far—word processing, electronic networks, hypermedia, and the conflating of the three on the WWW—offer new challenges to the community of literacy educators and researchers. But there are also important issues surrounding the incorporation and use of the new technologies within educational contexts that we need to pay more attention to in literacy research than we have in the past. We are thinking here, for example, of the critical necessity to incorporate into our research the observations made by cultural critics (e.g., Feenberg, 1991; Kramarae, 1988; Poster, 1990; Spender, 1995), who remind us that computers fundamentally shape, and are shaped by, cultural values. Hence, these machines continually magnify and reproduce the complex social conditions connected with those values in fundamental ways much like educational systems in general. Computers, then, far from encouraging change, can also serve to support stasis within the existing educational and cultural systems. And, unfortunately, there has been very little research in computer-sup-

ported literacy contexts that traces how these cultural processes unfold or that identifies the locations of gaps in this over-determined web of cultural, political, economic, and ideological relations.

Radical pedagogues (e.g., Freire, 1990; Hooks, 1989; Luke & Gore, 1992; Shor, 1987) can help us see that change in computer-supported literacy environments is often met with a special degree of conservatism. This is in part a reaction against the fear that computers will dehumanise classrooms and also as a result of a scepticism that computers can really support radically democratic, systemic-level changes in the values that shape teaching and learning. Hence, attempting educational reform within computer-supported literacy projects can often prove slower, more temporary, and even more partial than change within nontechnological projects. Among the many problems that few researchers have studied and that continue to plague both traditional and computer-supported literacy classrooms are the continued marginalisation of individuals due to race, gender, age, sexual orientation, or handicap; the silencing, intentional or unintentional, of certain segments of our population; and the unequal distribution of power within economic and social groups. These problems persist because they are systemic and politically determined, not only within the framework of our educational systems but also within that of our cultures and their economies.

The study of implementations of radical pedagogy in computer-supported literacy classrooms can help us see that reform efforts, especially when they are computer-supported, must proceed simultaneously on multiple levels if we hope for success: in local arenas—in the minds of individual teachers and students and within the virtual spaces of computer-supported learning environments—and in broader political arenas where social and educational policy is made. Recent studies of the use of electronic discourse within local classrooms (e.g., Faigley, 1992; Regan, 1993; Romano, 1993) begin to show us the complexities that attend its classroom use and the difficulties of bringing about reform

even in classrooms led by critical pedagogues. In separate studies, Faigley, Romano, and Regan, for example, suggest that issues of gender, multiculturalism, and sexual orientation cannot be addressed so easily. Even when teachers are able to make students more sensitive to the problems of the marginalised—which Faigley, Romano, and Regan weren't always able to do—translating this new awareness into venues for productive action remains one of the most pressing challenges of the decade.

Some scholars suggest that we cannot hope to understand the roles technology plays in our literacy classrooms until we look critically at the broader relationships between humans and machines in our culture. Mark Poster (1990) and others (cf. Gibson, 1984; Zuboff, 1988) have pointed out that we are technological and cultural subjects, created in part by the machines we ourselves have created and written continually in our discursive practices on these machines. We and our students are, in this sense, part technology ourselves, in the way we write, in the way we see the world, in the ways that we think. When this concept of being a cyborg starts to worry us, as it often does, we turn to feminist critics such as Cheris Kramarae (1988), Dale Spender (1995), Donna Haraway (1990), Anne Balsamo (1995), and Claudia Springer (1991) for radical revisions of technology and the roles it can play in our culture and our educational systems.

And the two of us have begun to incorporate some of this thinking in conducting our own research. One of the authors, for example, carried out a study (e.g., Selfe & Meyer, 1991) in which she and her colleague looked at networked discourse on Megabyte University, a listserv aimed at those English professionals who teach with computers. Selfe and Meyer conducted their study with an eye toward assessing the power relationships within the online conference and used descriptive statistical data from their analysis of the postings along with an analysis of the patterns of individual participation in the conference. Although this research was not aimed at a literacy classroom per se, the study revealed

that men and those who are perceived as having higher status in the field often get more air time than women on the nets. The two of us were subsequently able to apply some of the same research perspectives to a study we conducted within our own classes at our separate universities (e.g., Hawisher & Selfe, 1992). And although we were unable to document similar gender inequities in online classroom discourse, we did find an interesting conversational pattern regarding the role of teachers in online discussions. We had set aside these electronic spaces as discussion areas for students and had purposely refrained from participating, hoping that the students would claim ownership of the e-space. What we found, however, was that Hawisher and Selfe dominated the conversation every bit as much as they might have in off-line class discussions in that they were hailed and referred to more than any other participants on the list. Rather than being spaces uninhabited by teachers, even when the teachers do not contribute to the discussion, the pattern of participation in some electronic conferences may demonstrate just how much teachers' ideas and attitudes hold sway with students.

More recently, one of the authors, in collaboration with Patricia Sullivan, conducted a study of the online lives of academic women in composition studies (Hawisher & Sullivan, in press). Questions driving the research concerned how 30 women academics perceive power circulating in electronic contexts and how they negotiate authority within these spaces. The research took place entirely online and focussed on two sources of data: e-mail interviews and transcripts from a listserv named women@waytoofast, an electronic discussion group that the women themselves constructed in connection with the study. While the online interviews begin to shed light on how these women in composition studies—graduate students and faculty—understand their participation in electronic discussion groups, the listserv transcripts reflect the ways in which the women carve out online identities for themselves. In looking at a particular group of women, whom the equalisation phenomenon is

said to benefit, and in tying the research to a study of online gender roles, the inquiry illustrates another approach to research open to literacy researchers. Our tentative conclusion from the study is that online environments are neither egalitarian spaces for women nor spaces devoid of power; some women prevail on the nets despite what feminists have recently regarded as rather hostile environments for women (Kramarae & Taylor, 1993). When some of this thinking is used to inform studies of other groups of women—adolescent women, for example—we might well find other patterns of participation. And, indeed, in a study Nancy Kaplan and her daughter, Eva Farrell, conducted (1994), they found that a group of adolescent girls were very much able to garner influence for themselves in the electronic discussions in which they participated for recreation. In looking at a group of adolescent girls outside the school setting, Kaplan and Farrell's study illuminates some of the generational issues that literacy researchers have only begun to explore.

But other kinds of studies are also needed: those that look carefully at face-to-face and online environments in which literacy teachers and students are increasingly asked to participate. Little research of which we are aware, for example, has looked at the reciprocal relationship between electronic class discussions and the face-to-face contexts in which teachers and students meet together. Little research has attempted to map the geographical and topological surveys of electronic spaces within classrooms onto the existing political, intellectual, and ideological terrain of our cultures. We hope that this article can serve as an impetus for such work, which must be undertaken if we are to understand the relationship between technology and our literate selves more fully. Although it is not possible to predict the degree or magnitude of the changes that will continue to occur on the technological front, we need to make sure that the revolutionary claims made for the use of computers in education—claims that have little to do with the reality in which schools, students, and teachers use computers—are informed by the kinds of research literacy educators prize.

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Notes

[1] Although we present first the research in word processing and then move on to electronic networks and hypermedia, we do not want to suggest that we view the field as a fixed entity moving through time—in other words, that first we discovered word processing, and then electronic networks, and then hypermedia. Not only is this misleading (e.g., some hypertexts were available in education before electronic networks became popular), but it tends to ignore the perspective that the field and those within it are always changing, with some experiencing now what others experienced 15 years ago. We ask, therefore, that our chronological organisation be viewed as a framework through which we may tell the story of the field's research without sacrificing its complexity.

[2] For a sampling of those few noteworthy school-based studies in which the cultural context plays a vital role in the research design, see Dickinson (1986), Herrmann (1987), and Greenleaf (1994).

Reading and Writing the Internet

Phil Moore

In the world of electronic writing, there will be no texts that everyone must read. There will only be texts that more or fewer readers choose to examine in more or less detail.

(Bolter, 1991, p. 240)

I am sitting looking at a copy of a paper written in 1993 by Marc Andreessen describing a then new area of work at the National Centre for Supercomputing Applications, University of Illinois at Urbana–Champaign, Illinois (USA). In it he talks about a new hypermedia-based information discovery and retrieval system on which he and his team had just started work. Its name was Mosaic, the first World Wide Web browser and the single application that was responsible for making the Internet accessible to a community far wider than the academics and enthusiasts who had been using it since it started in the early 1960s. Mosaic provided a means of navigating the Internet that did not rely on a word-based approach nor on an understanding of the computer language UNIX, but through *hyperlinks*—high-

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lighted text which, when clicked, acted as a link to other texts that could be held on the same computer or on one on another continent.

That was 1993. Today, millions of people use the Internet regularly, accessing texts held on computers on all continents through the use of the World Wide Web (WWW or Web).

Why this astonishingly rapid growth has come about is not the subject of this article, although there is potentially an interesting study waiting to be done. What does interest me here, however, is the fact that we are witnessing the birth of the first significant artifact of the long-heralded information society, an artifact that must concern all of us involved in the development of children's literacy. Conception and birth of the Internet may have taken a number of years, but we are seeing a greatly accelerated process of maturation than of other forms of information technology (IT). In the United Kingdom (U.K.), for example, it took 16 years for the computer-pupil ratio nationally to move from 0:0 to 1:18—in one year alone, an estimated 20 percent of all U.K. schools had connected to the Internet.

I believe that the Internet offers teachers of English a rare opportunity: New media do not appear all that frequently, especially ones that have a sudden and dramatic impact on the consciousness of whole nations. (A colleague of mine reported that, while on holiday in rural Italy recently, he noticed a remote village shop offering a service for vacationers to log on and check their e-mail.) The Internet offers us an opportunity to exploit the medium in the development of children's literacies, but it also challenges us to understand how it extends our conceptions of literacy.

What Is the Internet?

The Internet itself can be seen in a number of ways. Technologically, it is a vast network of computer networks normally accessed by home and school users via an Internet Service

Provider (ISP) over standard telephone lines. This network contains a range of functionality, including the ability to log on to a remote computer to send or receive files, to navigate through a database, or to access information stored as words, images, or sounds. The Web is only one means of navigating the network, but is far and away the easiest way to do so for those uninitiated in esoteric computer languages.

Practically, for a user of Web browser software, the Internet consists of a series of screens containing words or images. Some of these words or images act as a link to other screens containing information; using a mouse to point at and click on these links, the user is taken to the next screen. The information on these screens can be coming from anywhere on the Internet—a different town, a different continent—but the user doesn't need to know its specific location in order to access it. In addition, it is possible to send and receive e-mail, a function which has existed on a number of networks for many years but which is enhanced on the Internet by the ability to attach files to a message, files that can contain words, images, sounds, or video.

The functionality of the Internet is increasing with sometimes bewildering speed, and the basic functions of navigating through the vast store of information available worldwide are being supplemented by the ability to view video and listen to audio in real-time (i.e., without downloading a file), to animate images presented on-screen, and to have the screen separated into different *frames*. This latter development I consider critical to the educational relevance and usefulness of the Internet and I shall return to it later.

The Internet and Literacy

There has been much debate over the years about the need to include IT texts in any definition of literacy. By *IT texts* I mean any text containing word, sound, or image, whether singly or in combination, which is produced using, or held on, any form of IT.

For example, Tuman (1992) contains an interesting (if rather negative) discussion of some of the ways in which definitions of literacy are changing in response to technology.

Space does not allow for a detailed review of that discussion in this article. However, to place my stake in the ground, in 1993 I was one of a group of people brought together by the National Council for Education Technology (NCET) to consider what the English curriculum might look like in the 21st century. This task was not futurology, which, although fun, is inevitably doomed to failure, but a considered development of a view of how an English curriculum might be constructed so that it can reflect the changes in the world of the learners it serves. Central to the group's considerations was the notion that a curriculum for literacy for the future could not be

> constructed on the principle of identifying specific texts or text types as the object of study. [The curriculum] would have to have at its heart that literacy depends not upon knowledge of texts but upon knowledge about texts and that learners should be taught not just to read texts but to read against them. (Tweddle, 1995, p. 6)

Some writers have examined these ideas in more detail; for example, Nancy Kaplan has gone further than most in considering the nature of electronic literacy or "e-literacies" as she calls them:

> Two distinct kinds of electronic literacy need to be acknowledged: One kind entails making a mark—being able to record language or pictures or whatever in some form or other, to store and to retrieve the records, perhaps even to combine these records in meaningful ways; the other entails making one's mark—in print's terms, being published, authorised to speak on a given subject. (Kaplan, 1995)

I would go even further than Kaplan, however. While agreeing that children (and adults) need to be literate as users and makers of texts in the new technologies (including the Internet), I would argue that the technology itself can be used to explore a range of literacies, including those that are print based.

In the rest of this article, I therefore wish to look at the nature of texts on the Internet and at some of the related skills, knowledge, and understandings that users must develop in order to be critical users of the medium, at how the Internet can be used to support the development of literacy in more general terms, and at some appropriate teaching strategies for its use.

What Is the Nature of Internet Texts?

For all that the Internet is one expression of the convergence of computers and telephony, I would estimate that 98% of the information currently on the Internet is print essentially transferred to another medium. For this reason, some observers are seeing the Internet as "a renaissance of writing and a rebirth of small local publishing," (Abbott, 1996, p. 3). However, for a number of reasons, I would argue that this view diminishes an understanding of the Internet's potential impact on teaching and learning and that it obscures the distinctive nature of the medium and of the types of text it enables.

One outcome of the NCET's considerations was a framework for considering the constituent elements of texts. Briefly, this framework set the range of possibilities that exist in the construction of any text in any medium. For those readers interested in a more leisurely examination of the group's work than is possible here, I would commend Tweddle's (1995) excellent summation of our work. However, I will draw upon the elements of the framework contained within that article to assist in considering the significant features of Internet texts.

Author-Originator

The provenance of any text affects how we approach it as readers or users. With print-based texts, the concept of an author is a familiar one; most of us understand that the person named on a book cover is not totally responsible for the work—the copy edi-

tor, the editor, and the typesetter, we know, all have some hand in the final text. With IT, however, the process can be far more complex. For example, a recent, very popular CD-ROM game called *Myst* lists over one hundred people in its credits. Further, it is often impossible to know how many hands have been at work when a word-processed file is read—amendments leave no marks or traces of individuals. What is true of significant texts in everyday life is true of IT texts: Few are the result of only one hand.

Thus the concept of author is becoming strained in relation to IT texts, and it may be more accurate to speak in terms of an originator—a person or group who created the first version of the text in question. With the Internet, it is clear that the notion of an originator (as opposed to an author) is even more appropriate as some texts on the Internet depend on a whole range of people creating them. For example, newsgroups are a means of carrying out an extended discussion with successive comments, building to create a written dialogue or a site called The Palace (http://www.thepalace.com) where texts are created by whoever enters the space. In these types of Internet texts, it is clear that there may not even be a shared purpose by those contributing to it.

For those using the Internet, therefore, it is often difficult to understand whose hands have been at work on the pages they are seeing. And, unless the user understands how to decode the address of the page being viewed, there may not be any indication of where it may have been created. For many pages it is also difficult to find a date when it was composed.

As with any technology, be it writing or IT, there are skills to be learned in the creation of text. The particular language of the Web is called hypertext markup language (HTML) and consists of a number of *tags* that tell the software how to display the words and images on any particular page. As the nature of Internet texts becomes more complex, so have the formatting tags within HTML, so that now, to create a Web page that utilises all the latest tricks, originators are having to learn an ever more complex language.

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This increasing complexity has its mirror in the early days of IT when many teachers started to learn programming languages in order to create computer programs, which enabled them to achieve their teaching objectives. As the capabilities of computers became more complex, teachers became increasingly at the mercy of commercial producers of programs because they no longer had the time or expertise to create complex programs.

The difference with the Internet is that we have quickly moved to the point where programs are being released which are WYSIWYG (what you see is what you get), that is, you can create a Web page without having to learn the intricacies of HTML. Such editors have allowed users to create Web pages quickly and have exposed the more significant issues relating to how to construct a page that communicates its messages effectively. The ability to create an effective Web page draws on a number of skills and understandings, not least of which are the ways that words and images can interact; it also demands an understanding of the nature of the medium itself.

The Medium

Potentially, Web pages can contain any combination of word, sound, and image, and pages around the Internet are using them in increasing layers of complexity. Because it is a hypertext medium, clicking on any object could lead to other pages or other objects, and so not only is there a loss of the sense of linearity explicit in the print medium, but there is also a distinct possibility of losing one's way. With a book, it is clear where to start and where to finish, and it is easy to understand that page 15 comes before page 73. Reading an Internet text, on the other hand, is like a frog jumping around a three-dimensional lily pond: It can be difficult to stand back from the text to see where you are in relation to its whole.

Various navigational aids are provided, both within the Web software (the browser) and, sometimes, within an Internet site. However, these often have their limitations, for example, a browser's listing of where you have been merely contains the titles of

the pages that you have visited. For this reason, reading and writing the Internet calls upon an understanding not only of how texts are created, but also of the range of possible structures that whole texts can adopt within the medium and, further, developing skills of tracking where you are at any one point within that structure. I am sure there is a great deal of work still to be done in understanding how children conceptualise texts, particularly those where there are no physical reference points.

Another literacy issue with the Internet concerns the permanence of text within the medium. The phrase "words that dance in light" was coined (Chandler, 1984) to provide an image of not only the nature of text in IT media but also of its impermanence and lack of closure: When is an Internet text finished? The Internet introduces another variable into this equation—location, as it is not rare for Internet addresses of any given site or page to change. But there is a further dynamic that must be taken into account: The Internet itself keeps changing. Within 3 years we have seen the Internet change from a word-based system to one where audio and video can be experienced in real time. Who knows what we will be able to do on the Internet in 5 years time?

Thus, not only are texts on the Internet ephemeral in nature, they are also volatile, a vivid antithesis to print. A curriculum that restricts children to a diet of texts that are fixed or purely print based, therefore, does not give them opportunities to develop their understandings of, and skills with, a burgeoning technology that is becoming a purveyor of many significant texts.

The Gatekeeper

The notion that an author is not the only one responsible for a particular book suggests that there are a number of gatekeepers in the process of publishing. The publisher may be the most significant gatekeeper, for without the publisher choosing to make the book available, it may never see the light of day. Within a classroom, of course, the gatekeeper is more likely to be the teacher

him- or herself, making decisions about what texts the pupils will interact with during lessons. In these terms, for pupils, gatekeepers can be invisible (the publisher) or visible (the teacher).

And so it is with the Internet, except that there are significant extensions of these ideas. Chief among them is that anyone with space on an Internet server can publish whatever they like, without having to submit the text for others' approval. This has led to an explosion of personal texts being published for a wide audience in a manner not possible through print technology. They range from What's in my fridge? to personal treatises on the nature of existence.

However, while some are claiming (including the U.S. Supreme Court in a recent ruling) that the Internet is the greatest force for democracy yet developed, it is important to recognise that not everyone has access to the medium. Despite the apparent freedom of the Internet, every inch of its millions of miles of network is owned by someone and, with rare exceptions, users must pay to access it. This, and the need to use a computer manufactured within the past 3 years, means that large sections of communities will be denied access to the Internet.

Even when on the Internet, access to all the texts available may well be restricted by people other than the user. For example, it is possible for some Internet providers to make certain texts off limits, most likely because they have decided that these particular texts are inappropriate. Indeed, there is software being sold that automatically prohibits access to some Internet texts because they have been found to be in some way undesirable. Just who makes those decisions, and on what basis, is often very difficult to discover, an issue in itself for readers and users of Internet texts.

Form

As with any new medium, the Internet has brought with it developments both in the forms and structures of text available as well as in the nature of the language used within those structures.

For the most part, the Internet is composed of pages of information that can combine word, sound, and image. As I have pointed out, this has led to forms of text that are very dynamic and that in their creation and use demand the deployment of a range of knowledge, skills, and understandings different from those required for print-based texts. A novice user of the Internet, for example, will have to learn a whole range of ways of navigating texts, from clicking on underlined text or images in order to move to another text to scrolling down a text in order to see its entirety. The novice will also have to learn that, in most cases, clues to the provenance of a page—the author's name and, possibly, the date on which it was last amended—will appear at the bottom of the page.

There are some forms of text that are distinctive to the Internet, for example, newsgroups, which are the most-used discussion forums. To engage in discussion, the user chooses a newsgroup with a subject of interest from the thousands available. The subject of the group is given in its title, which adopts the form generic.generic.specific, as in comp.sys.mac.games or, in plain English, computer-systems-mac-games, containing a discussion of games available on Mac computers. Having subscribed to a newsgroup, the user logs in to the discussion, and the newsreader software downloads all comments that have been made since the user last logged on. The final form of this discussion will depend on how the software displays the messages; there are a number of newsreader software packages available. Typically, however, the software will allow for messages to be grouped by date submitted, by the person submitting the message, or by the subject of the message, thus enabling the user to organise the text in ways that he or she finds most useful.

A distinctive form of language on the Internet arises from the facility for users to interact with each other in real-time through *chat* areas, where what is typed by one person appears on others' screens for them to read and react to. This leads to written conversations, spoken and written forms of language coexisting in fre-

quently interesting ways. The attention here is on communicating in writing; a lack of accuracy in spelling or punctuation is accepted as long as the message is clear. Indeed, although such interactions are in writing, people refer to this activity as "speaking" to others.

Another interesting feature of the language used in person-to-person interactions on the Internet is the explicit recognition that written language does not convey much of the paralinguistic features of conversation. As one means of overcoming the difficulty of conveying, for example, tone and inflection, the use of the "smiley" is widespread. This is a combination of punctuation marks that gives an image of a face with rudimentary features. It is thus possible to indicate irony by using a colon, a dash, and a close parenthesis :-) or to indicate a wink by using a semicolon, a dash, and a close parenthesis ;-).

There is, of course, a clear distinction between writing that is in real time (such as in chats) and those that are composed off-line (such as in newsgroups). Understanding such distinctions, and their implications for both originators and users of texts, is an important skill when using the Internet.

Audience

The estimated number of Internet users is made up of a whole range of people, from children to adults, from students to bankers, from rock fans to nuns. The audience could be one person (as in an e-mail), a known group (as in a closed user group), or potentially, the whole Internet. Further, these audiences can be remote geographically, culturally, or temporally or focal. Each of the audiences will make its own demands on the originator of an Internet text, a fact which can provide some effective ways of focussing children's attention on the significance of audience in the writing process.

One striking feature of the individual members of this audience is their anonymity, the focus of the user being on the com-

munication, not the age, gender, race, or status of the person writing. As an example, I was engaged in a discussion on the Internet in a chat. One particular person was picking up on things I was saying about teaching and I found the comments particularly challenging. Later I discovered that the person to whom I was talking was 8 years old and lived in the United States. At least, that's what she said.

Writing effectively for such a diverse set of audiences can be a very challenging task, especially when the tools available to the writer are so powerful, potentially blending a range of media in a single text. As an added complication, it is very clear on the Internet that any one person's reasons for coming to a text may be very different to those which led to its creation. At the same time, there is a potential for interaction with those audiences which is unequalled in many classrooms.

Interaction

Looking around the Internet, it would be easy to adopt the view that, for many originators of text, the word *interaction* means pressing keys to move from one location to another. This is not a form of interaction that leads to learning and, if this was all the Internet had to offer, its value in the teaching and learning process would be questionable.

The advent of frames has begun to change perceptions of Internet texts, however, for it is now possible to have two or more different texts on screen at the same time. I feel this is a very significant advance in the potential use of the Internet for educational purposes, because it will provide new ways for originators to structure their texts. At one level, the use of frames will enable originators to guide the user, for example, using one frame for a set of instructions, sequences of activities, or a list of texts while using other frames on the same screen for displaying the texts that are the subject of the activity: an electronic worksheet, if you will. At another level, it will be possible for two people (or groups of peo-

ple) to look at two contrasting texts, reading them against each other, while talking about them in a chat area.

In these cases, the structure of "framed" texts can be seen to be providing ways for users of texts to reflect on them, something which is critical in enabling children to develop their literacies. I have written elsewhere (Moore & Tweddle, 1992) about the importance of teachers recognising how IT can support reflection in effective ways. I see the use of frames as the first step in making the Internet a very powerful medium for reflection on texts.

Of course, just as opportunities present themselves with the use of frames, the potential complexity of a screen full of frames, each with a discrete text, makes reading them a more demanding activity. For many children, used to understanding complex relationships between words and pictures, this will not present an insuperable challenge. However, creating such texts, and understanding how they can add to their choices as writers, can be more daunting.

What's the Internet Good For?

Even if my arguments are accepted, that Internet texts have distinctive features that are themselves worthy of attention in the classroom, the question still remains of what use the Internet brings to the teaching and learning of English.

Just as with other forms of IT, I do not believe that the Internet can be seen as replacing other resources or its use as a panacea. Indeed, the well-publicised dangers of the Internet, as well as its complexity and extent, mean that the teacher's role becomes even more significant in mediating and structuring children's experiences in order to take most benefit from its use.

Nevertheless, there is little doubt that the Internet can bring access to a much wider range of information and resources than are currently available in most classrooms. It is important, however, that teachers understand what forms of information the

Internet is best for. For example, a teacher recently complained to me that the service for which I am responsible had little information about spiders. She explained that her children had found lots of information on a CD-ROM encyclopedia, but had been disappointed when searching online. I would argue that reference books (whether in print or on CD-ROM) are often the most efficient means of discovering information quickly; at the same time it is obvious that they are not appropriate for volatile information. Searching the Internet needs to be carried out, therefore, with a realistic idea of what may be added to information that already exists in the classroom.

One aspect of Internet use that is difficult to undertake in any other way is collaboration with real audiences around the world. Clearly, the nature of the collaboration is what matters, rather than the remoteness of the partners. But, the benefits of children working with others who may live and work in very different cultures, or who may use different forms of English, are many, especially when language is the focus of that collaboration. One good example of this is a school in England that collected versions of the same fairy story from around the world written in the language that the children in the collaborating schools used. All those involved ended up with a rich collection of writings that showed the diversity of language in a powerful form and led to the creation of a range of dictionaries and thesauruses, as well as a fascinating anthology that was available for subsequent use.

When the ideas of using the Internet for collecting information and for collaborating are combined, the effects on the classroom can be even more profound. For example, the potential for children providing information for each other was explored as a preparation for a recent state visit of Nelson Mandela to England. Before the event, children in the United Kingdom and South Africa shared information about their lives and collected information about each others' countries in order to understand the context of Mandela's visit. It would appear that many of the stu-

dents involved in this work gained a deeper understanding not only of the event itself but also of the issues facing children in both countries. Some of the wide range of writings arising from this project can be found (at the moment, at least) at http://www.campus.bt.com/CampusWorld/pub/index.html.

Approaches to Using the Internet in the Classroom

Understanding that the Internet does have a relevance in the teaching of English is only the start, of course. Few teachers have experience of the medium and most will have to spend time becoming familiar with how to navigate and use it. It is worth reflecting, therefore, on some fruitful approaches to its use in the classroom.

While much is made of the volume of information available on the Internet, at the same time this is one of its greatest disadvantages. There is nothing more disheartening for a child than to be confronted with a mountain of information—how does he or she find what they are looking for? The number of *search engines*, sites that index the Internet and provide a keyword search facility, is ever increasing, but this is counterproductive when the search engines provide thousands of references as a result of a simple enquiry.

Encouraging students to search the Internet needs careful forethought by teachers. If the teacher wishes the child to find some specific information, the teacher will need to know that it exists and its location. In this instance, that location can be provided either as a page reference or via a set of "bookmarks," shortcuts that are stored in the Web browser. This latter is particularly useful for children who are new to the Internet, as it provides a structured search that the teacher knows will be successful. In other circumstances, it may be that an unstructured approach is more fruitful in that different children will find different texts which, taken together, will provide a richer set of resources than with

the structured approach—and the teacher does not have to do the search in advance. The serendipitous approach can also throw up materials that are not strictly what is required but that can create new avenues of interest. For example, searching on *planets* as part of a discursive essay could reveal that there is a piece of music that has the same name. This could open up a discussion about how different media convey similar information.

Another issue is what one does with information obtained from the Internet. With most browsers, it is possible to save any element of an Internet text to disk, making it available for incorporation into a child's own text. Recrafting texts for a different audience, purpose, or genre provides an important means of enabling children to reflect on reading and writing: Providing them with tasks that require the collection and transformation of Internet and other texts can be a powerful way of getting the best out of the Internet. It also overcomes a problem that is in evidence no matter which medium is being used—that of students just copying chunks of text and reproducing them unchanged in another format. For example, saving the different contributions from a discussion group or newsgroup to disk and then turning the different articles into a newspaper report requires a clear understanding of the issues being discussed, of the difference in the nature of the audiences, and of the language demands that the different media make.

The last example makes the point eloquently that the use of the Internet need not be distinct from other work in the classroom. The Internet can be used as a means of exploring aspects of language normally associated with print-based literacy as well as in its own right. For example, it has been observed frequently that children writing text, which will be published on the Internet, take a great deal of care about spelling and punctuation; when collaborating with others whose first language is not English, there is often an awareness of using language that the intended user of the text will understand. Considerations such as these may be

important when accepting offers from other schools to collaborate on specific projects.

An increasing number of education sites on the Internet provide places where like-minded teachers and children from around the world can meet, and they often provide projects that can be undertaken collaboratively. A benefit of using such sites is that there are frequently teachers and children who are more experienced in the use of the Internet. One extremely powerful language activity for children is to prepare a guide to the use of the Internet for others who are less experienced. Another benefit of such sites is that they frequently offer good ideas for exploiting the Internet in teaching and learning.

Conclusions

Looking back to the quotation by Bolter with which I started this article, I doubt that he was aware of the revolution that was about to happen on the Internet. Nevertheless, I find his comment particularly appropriate in the context of this discussion. In my reading, the emphasis is on the word *choose*, and part of any definition of literacy includes the ability to make informed choices as readers and as writers. The Internet not only increases the range of those possible choices, but also enriches them through access to a wide range of audiences in a variety of media. As teachers of English, we cannot afford to ignore its opportunities. Rather, we must face up to its challenges.

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Everything Is Connected: An Information Technology Program Comes Together

John Travers

Mitcham Primary School in South Australia has been in the forefront in using information technology for years, but I have to admit that real benefits for the curriculum have only begun to appear recently. With the clarity of hindsight, we can now see what has helped and hindered our recent progress.

In 1981 Mitcham was the proud recipient of 17 networked Tandy computers, which were given to the State Department of Education for a trial. They were exciting to have at the time but had quite primitive capabilities. By 1990 the school had a set of Commodore 64s and a small group of the easy to use Macintosh computers. During this period there had been a rapid development of computing skills among some staff but plenty of frustration as the new technology fell well short of its promise to affect schooling. The vast majority of students' computer time was taken up with word processing and teaching games.

Mitcham's community was proud of its leadership in the information technology (IT) area, made possible because parents were very supportive of its high cost. As well as keeping ahead in

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classroom computing, Mitcham was one of the few primary schools to install a library computing system.

During the mid-1990s Mitcham organised its computers in three ways: as a network of Macintosh computers in a computer room, in "pods" in corridors, and in classrooms. While some staff were actively involved in exploring computers for learning, most were finding their use a frustrating exercise. Lost files, faulty disks, and rather mundane applications raised questions about the value of school computing. Nevertheless, a major achievement for the school in the long run was the steady increase in staff skill and understanding of how to the use computers.

Over the last few years, the CD-ROM arrived along with dramatically more powerful computers, fast networks, scanners, digital cameras, and the World Wide Web. Dramatic images and a bounty of information are now available to children to manipulate and use.

While the technological eggs are finally hatching, the most important lesson we have learnt is that the introduction of IT into schools is a large, expensive, long-term experiment. It is a learning experience with exciting possibilities and with no end in sight.

It was really frustrating a few years ago when the school had some modern computers installed and a network, and yet teachers were reporting deep disappointment in using them effectively. There were reports of breakdowns in the equipment, disks lost, children stuck on one problem for the whole lesson, teachers who could not keep up with calls for help, and children who could not work independently. What we were finding out was that, like other activities in the classroom, everything is interconnected. New computers need skilled teachers, skilled students, good software, printers that work, and a host of other factors to make them effective tools for learning.

It can be discouraging to realise that all these elements have to be addressed together, but it is much more discouraging to see a major school program stall because we have only paid attention to some of these elements of success. It is a bit like having a din-

ner party. Good food and shiny cutlery will not ensure a successful evening.

This story is about some of the elements we found essential to build a strong IT program.

Teacher Proficiency

One of my mistakes has been to oversimplify to teachers the skills needed to instruct children in the use of computers. I have often rushed a teacher through a 10-minute demonstration of an application, and the teacher has gone off happily to take a class on the topic, only to find the class break down on minor gaps in their knowledge. Teachers' proficiency in anything they are teaching is crucial. But in the use of computers, there are some special conditions. Operating a computer requires a special set of skills and, while computers are becoming easier to operate, the capacities of the software are expanding rapidly. There is simply a lot to be learnt.

We have found that teacher skill, confidence, and motivation grow best in a short cycle where coaching and success in the classroom are essential elements.

Teachers will not invest large amounts of energy in learning a new skill without seeing evidence that it works in the classroom. Success in a lesson will motivate the teacher to a further skills lesson, to some practice, and then to application in the classroom. If there is success, the teacher will keep exploring.

Tutorials at the beginning stage allow the teacher to take the class through a structured exercise. Tutorial units have proved a valuable introduction to a skill for both students and the teacher who has just learnt the skills herself. The tutorials are step-by-step paper instructions taking the students through a process such as making a graph or setting up a Web page. They have been effective in guiding teachers through the crucial beginning stages where fear of failure and anger at looking foolish are just below the surface. The well-written tutorial allows the learner to be successful in private.

Coaches have been the best form of teacher support. Coaches are people who are on hand and are able to give support when it is needed, and when it is requested. We have gradually built up the number of staff who are competent and confident, and they have been more valuable for teacher instruction than the few experts on the staff. Whole-group instruction of staff has been important, but most learning takes place in private after an instruction session. Group instruction has been assisted by the purchase of a computer projector. Though expensive, the projector has made computer-room instruction much more efficient. Having a computer at home is obviously highly beneficial to learning the skills.

Coaching and maintaining that a whole staff focus on the use of IT are important to keep the short success cycles going. An element that has been important for us in teacher learning has been to regularly show what is possible so that teachers can be excited with the opportunities to enrich their classroom program. When these demonstrations come from the teacher in the class next-door, they are most powerful.

Another powerful form of motivation is for the school to be clear that learning how to use IT is not an option for a teacher in the late 20th century. It is important to have a school agreement that the use of IT is a necessary part of the modern curriculum. Of course for most teachers IT is not currently a major part of their class program, so it is an important role of the school leadership to talk convincingly about potential and expectations. This is not very hard to do these days even if one pays only modest attention to the impact of IT on the general community.

Leadership has been important in encouraging whole-staff learning. As the school principal, I have had a major impact on the school's policies and development because I am an IT enthusiast, but I discovered some years ago the dangers of playing the role of sole expert. This approach means that other staff do not have to take on new responsibilities and learning, and expertise is concentrated in one or two people. At Mitcham we decided to appoint

an IT coordinator in 1997 who had the advantage of being a very skilled teacher-librarian. Onto these skills she grafted skills in IT and is now a very influential coach and leader.

Stressing the Basics

For a number of years at Mitcham, we were fooled by children's apparent proficiency with computers. Their enthusiasm for computers and the skill of a few tricked us into believing that their skill levels were higher than they really were. Also, children usually used computers in pairs, so it was quite easy for the more confident of the pair to mask the lack of skill of the other. It was a rude shock to conduct some simple tests to find that many children had large gaps in their skills. This also explained why lessons were often interrupted by class members who could not solve their own problems.

We now have an R–7 skills list for the main applications and each year level is given specific skills instruction. One of the problems we uncovered was that most children were able to perform simple skills in, say, word processing, but they did not know about the second level of functions such as tabs, margins, use of columns, and so on.

We now treat computing skills like any others. They have to be explicit and systematically taught and reinforced before students are able to work with any degree of independence.

Software Focus

A focus on basic skills cannot be managed without school agreement on the main applications to be used. We found that with a focus on basics, children are able to work more independently and concentrate on what they are using the computer tool for, rather than on how to manage it. From Year 5, students are able to work independently on a range of tasks.

One of the positive features of computing that can turn into a trap for school programs is the dazzling array of software that is available. Apart from the routine applications of word processing and drawing, there is animation, image and sound editing, video integration, and more. The danger is that individual teachers, or the school as a whole, may dabble in a wide range of applications and do none of them well. Students may have an excellent year learning about computer animation with a teacher who is a whiz in this area, then never use these skills again.

We have selected two major applications to be the core of the program at any year level. All year levels concentrate on Claris Office as a general all purpose application for word processing, drawing, and spreadsheets. Reception to Year 2 use KidPix Studio as a multimedia application. Years 3 to 7 learn to use Netscape Communicator for Web authoring.

Other computer applications are used as ancillary to the two major applications. These include Photo Deluxe for image editing, scanners, and a digital camera.

In 1998 we introduced mid-year school-wide tests for Years 2, 4, and 6 children to assess their performance in basic skills in Claris Office. The same test is used for both Years 4 and 6. We give children and parents the results along with a year-level average scores.

Equipment, Network, Deployment

The biggest single factor in our IT program's improvement over the last 18 months has been the installation of a high-quality network. There is a huge leap in the quality of what can be done in a school when the individual computers are linked by a fast network to a file server. At the same time, we acquired up-to-date computers with internal memory of 16MB and storage of 1GB.

Our 40 Apple computers are connected to a small file server by Ethernet cabling. Six are located in the library, 17 in a com-

puter room, and two sets of 8 in pods in a corridor outside classrooms. There are only a few older computers in individual classrooms. The computer room is used largely for skills learning, and the two pods allow easy use by groups released from their nearby classrooms. The computer room use is enhanced a great deal by a good-quality computer projector. The library computers are booked by teachers for class use and are heavily booked by children before school and at lunch times. The computer room is booked for every lesson. Junior Primary classes have one lesson a week, Years 3 and 4 two lessons, and Years 5–7 one lesson, supplemented by their access to the two pods.

One of the main benefits of the network is that student files are now stored in one place. Students using any of the computers can quickly find their own folder of work. The second major benefit of the network is that we have been able to set up a store of common resources that are available to all users. Most important of these is the school's Intranet, a large, ever growing collection of teacher- and student-prepared material written in Web format. The Intranet has been a very powerful tool for stimulating teachers' curriculum imaginations. It now houses the school history, a hundred or more book reviews, a study of local houses, plus photo presentations on the 1997 Year 7 graduation, and the school's Swimming Carnival and Athletics Day. The flexibility of Web authoring means that it is very easy for additional material to be added to this growing resource. Additions to the Intranet are managed by the IT coordinator. With her assistance, classes and individual students are beginning to add their own home pages.

A network version of the *World Book Encyclopedia* on the file server also provides every user with no-fuss access to a large reference source.

The deployment of computers has been a constant issue, and the pods that are accessible to classrooms are proving very effective. Their location allows easy supervision, but they require students who can work largely independently while the remainder

of the class works on other tasks in the classroom. One student per computer has proved to be much more effective than two. The success of the pods has been due in part to the allocation of one child to a computer, which ensures that they work intently on their own work. Supervision has not been a problem.

We recently added eight eMate portable computers to the pool of resources as a tool to input text. They are currently being used in a trial of touch-typing instruction, using the Ultrakey typing tutor. If successful, the very easy to use and highly portable eMates will allow us to bring all Year 4 children up to a level of independence in touch typing, which we anticipate having major benefits in outputs in later years.

Curriculum Imagination

The hardest element to achieve in the IT jigsaw has been curriculum imagination. This is the ability to imagine ways of enhancing curriculum delivery using the new technologies. It has been the hardest, not because teachers have lacked curriculum ideas, but because it is the most dependent element. It is dependent in many ways. A teacher who has a good idea for using IT in her classroom is dependent on computer availability, the quality of the computers and software and the availability of ancillary equipment, and the children's skill level achieved in previous years. The other aspect of dependence is that the teacher has to have a clear idea of the capabilities of the equipment and software before she can imagine how it can be used creatively.

At Mitcham, teachers' curriculum imaginations in relation to IT has been much more evident since our facilities and training systems have been better established. The "Ah ha!" factor can only occur when the teacher has the background knowledge and the facilities to be able to visualise success. We have found that the success cycle does not have to involve a highly complex learning activity. It works very well for small-scale tasks. The classroom

teacher's curriculum imagination works best in a school environment that recognises the experimental nature of trying out fresh ideas and that we learn from mistakes.

The Future

We expect to gain resources in the future to give us a more extensive and powerful network with a large NT file server connected to an integrated services digital network (ISDN) outside connection. This will allow us to have links between the administration network and the curriculum network, internal mail, and routine use of the World Wide Web. The network will become a pervasive part of school administration used by teachers and the office staff: by teachers to record student and resource information as well as to access school and state-wide information; and by the administration to keep student and school records.

We can only see a little way into the future in using IT. Our long-term goal is for children to be using the technology to support open-ended learning and for them to be independent and resourceful learners.

Appendix
Computing Skills List—Years 3, 4, and 5

The skills list below is regularly revised.

Year 3

Claris Office

General Skills
Knowledge of keyboard
Using both hands to type
Correct posture
Saving (where to save)
Naming, deleting, copying files
Closing, quitting, ejecting, trashing
Zooming in and out
Switching between programs (View)

Word Processing
Highlighting (both directions)
Inserting
Editing–Undo
Cutting and pasting
Changing fonts and sizes
Justifying (left, right, full, centre)
Punctuation and spelling
Spell check

Drawing
All tools
Colours (lines, fill, and text)
Patterns (lines and fill)
Thickness of lines
Resizing using handles
Reshaping
Using of Draw Tools in Word Processor
Inserting and editing Graphics

Visual Arts
Choosing appropriate fonts and sizes
Choosing appropriate styles
Choosing appropriate line spacing
Choosing appropriate positioning on page
Using borders, lines, and shapes

Spreadsheets
Collecting and entering data
Creating simple graphs and charts
Modifying graphs with labels

Other Computing Skills Year 3

Kid Pix Studio
Making a slide show
Making a slide show folder
Saving into a slide show folder
Using naming and labeling system
Selecting file for a slide
Adding a sound
Recording a sound
Selecting a transition
Selecting length of slide on screen
Relocating slides
Making animations
Importing pictures from other applications

CD-ROMs
For information
For problem solving
For skill development

Communication
Connecting to the Internet*
Using e-mail (in and out)*
Adding attachments in e-mail*

Netscape Composer
Creating and editing text
Inserting and editing graphics
Creating backgrounds
Adding tables
Creating links

Intranet
Developing awareness of Shared Files
Developing awareness of Student Store
Using Intranet to search for information

Appendix (continued)
Computing Skills List—Years 3, 4, and 5

The skills list below is regularly revised.

Using Intranet to publish work

Skills marked * are optional. Children may be given experience in these. Please indicate if they are.

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Year 4

Claris Office

General Skills
Reducing and moving windows
Using Chooser and Page Setup for printing

Drawing
Rotating
Flipping
Duplicating

Painting
Using brush
Spray Can
Eraser
Pencil Tool
Selection Tool
Rectangle Tool
Lasso Tool
Magic Wand
Eye Dropper
Paint Bucket
Special effects (using transform)

Visual Arts
Layering objects—moving backward and forward
Using backgrounds
Considering visual impact/overall appeal
Using tools creatively
Using appropriate colours and patterns
Locating and using relevant graphics
Creating graphics from scanner*
Creating graphics from disks and CDs
Desktop Publishing
Using Columns

Other Computing Skills Year 4

Electronic Information
Processing
Defining key issues
Locating relevant sources
Isolating relevant information
Copying pages and pasting into ClarisWorks
Sorting information under headings

Skills marked * are optional. Children may be given experience in these. Please indicate if they are. Mark each box with a '/' if the children are skilled in this area. Mark with a 'X' if they have had experience in the area but are not yet skilled.

Year 5

Claris Office

Word Processing
Indented and Hanging Paragraphs
Tab Key, Tab Markers
Create and Edit Columns
Bullet and Outline Formats

Drawing
Gradients
Locking—Unlocking
Scale selection
Grouping—Ungrouping
Layering
Turning off Autogrid
Using four arrow keys
Aligning objects to grid
Aligning objects to each other
Using invisibles
Text Box Wrap

Visual Arts
Using appropriate contrasts

Appendix (continued)
Computing Skills List—Years 3, 4 and 5

The skills list below is regularly revised.

Developing awareness of space
Incorporating perspective
Creating graphics from WWW
Creating graphics from digital camera*

Multimedia Presentations
Creating slideshow with text and graphics
Adding and creating sounds*
Creating animations*
Creating and capturing video*

Desktop Publishing
Inserting Page Breaks (new pages)
Inserting Section Breaks
Inserting Headers, Footers, and Page Numbers
Inserting Date and Time
Using Text Frames
Inserting and using grids and tables
Adjusting and deleting frames
Defining styles
Inserting symbols
Using superscript and subscript
Changing character spacing
Formatting
Page Setup (Layout, Reduce, or Enlarge)

Spreadsheets
Using formulae for calculations
Interpreting and using results

Databases
Locating and collecting information*
Sorting and entering information*
Modifying and presenting information*
Using information for queries and reports*

Integrating the Applications
Can use all the processes in one document

Other Computing Skills Year 5

Communication
Searching WWW for specific information
Identifying relevant information
Using and adding Bookmarks
Downloading, copying, saving, and printing
Using Graphics from WWW
Using Sounds from WWW*

Electronic Information Processing
Citing references clearly
Publishing information suitably

Netscape Composer
Adding sound to Web pages*

Skills marked with * are optional. Children may be given experience in these. Please indicate if they are. Mark each box with a / if the children are skilled in this area. Mark with a \ if they have had experience in the area but are not yet skilled.

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Making Moves With Information Technology: An Information Technology Centre Works Closely With the Resource Centre in a Small School

Wendy Edwards

At St. George College in South Australia, a small Greek Orthodox Kindergarten–Year 8 school where I am teacher-librarian, we have been increasing students' understanding and use of information technology (IT). We approached this in three ways:

- establishing an information technology centre that can be used in tandem with the resource centre;
- purchasing general-reference and subject-reference CD-ROMs through the resource centre for use in resource-based learning units; and
- supporting teachers in their use of information technology including CD-ROMs, applications, and educational software.

Adapted from Edwards, W. (1997, March). Making moves with information technology. *Practically Primary*, 2(1), 11–16. Permission was obtained for the children's work shown in this article.

We have come a long way in a short time, and our students are beginning to feel that information technology in its many different forms is part of most areas of learning and something that they have the skills and confidence to use effectively.

A positive factor in these developments is the connection between the information technology centre and the resource centre. As teacher-librarian and information specialist, I have been involved in planning and establishing the information technology centre, and also in assisting teachers with training and development. The subsequent appointment of a computer teacher has meant that information technology studies are expanding rapidly at the school. Timetabling allows the information technology centre to be used not only for computer lessons, but for word processing in Greek lessons, and for research and presentation during library lessons. We try to achieve a balance of explicit skill development and integration of elements of IT into as many curriculum areas as possible.

The Information Technology Centre

Two years ago our school information technology resources comprised a library network of four computers for the Book Mark system, a stand-alone computer with a CD-ROM drive, a modem, and some Macintoshes of varying antiquity in classrooms. The information technology centre has since added networked Pentium computers using Windows 95, each with CD-ROM drive, linked to a laser and a colour printer. Plans for the future include a datashow to facilitate skills teaching, adding more Internet connections, and upgrading the resource centre system.

Software for the centre was chosen to provide initially a small range of basic applications and educational programs. Aside from the cost involved in purchasing a licence or 15 copies of software, the Information Technology Committee felt that too much new software would be daunting for staff and students alike. In their

own training sessions and in teaching lessons, teachers have explored the possibilities of the software and focussed on gaining competence and confidence in particular features, which they then apply and integrate as part of a unit of work. One class worked on designing frames for headings in their computer lesson, wrote short poems in class, then word processed the poems and added attractive frames to the titles.

Our school is using Microsoft Works, Claris Works Office 4.0, Broderbund Kid Pix Studio (a favourite with students of all year levels), Typing Tutor 7 (for teachers or students to work on keyboard skills), and our next acquisition will be an atlas program. Educational software has been provided in three sets of five (Davidson Reading Blaster, Math Blaster: In Search of Spot, and Edmark Thinkin' Things 1). Our special needs teacher has made considerable use of these, and class use is being monitored, in order to determine how useful this type of program is, and how best to manage it in terms of whole-class, group, or individual use.

General References and Subject Reference CD-ROMs

Reference software has been significantly upgraded to support teaching units and provide for students' general interests. It is purchased from the resource centre budget but used mostly in the information technology centre where each CD-ROM has been installed on one machine. The huge range of CD-ROMs available makes it difficult to choose. Recommendations from colleagues and suppliers are of some help. I prefer to buy from suppliers who will let us try and evaluate the products on our machines, because it is important to make sure that older software written for Windows 3.1 really does run smoothly on Windows 95. I also like to check the depth of information, reading level, and ease of use before buying.

For general reference we have several versions of Microsoft *Encarta*, which are very popular with students, as well as

Compton's Multimedia Encyclopedia, Microsoft *Bookshelf*, and *Webster's Encyclopedia of Australia* and *Exploring Nature*; although not detailed, these last two have a wide coverage and interesting illustrations. Our Software Toolworks *World Atlas* is old and well used. *Fauna Australis* (from Trigon & Healesville Sanctuary, Victoria) is highly recommended for offering two levels of text as well as clear graphics; for animals all over the world, students enjoy Software Toolworks *The Animals* (San Diego Zoo, California). Microsoft *Musical Intruments* and Softkey Bodyworks are equally useful for learning units or general interest. Not surprisingly in a Greek Orthodox school, the most popular CD-ROM for student use at lunch times is Microsoft *Ancient Lands*.

Teaching With Information Technology

At St. George College, we teach information technology from several perspectives: the computer teacher deals with it as an area of study, while other teachers use it as visual text, as a source of information and means of recording notes and ideas, as a presentation tool, and as a teaching method in some subject areas. Class teachers begin where they feel comfortable, and lessons include free exploration, peer tutoring, problem-solving tasks, structured step-by-step skill development, and guided production of documents and slide shows.

The *Statement on Technology for Australian Schools* (1994) involves students in the historical, social, and technical features of computers and associated hardware and software. As an initial demystification of the new information technology centre, one of our classes created a glossary of computer terms where students researched a term (e.g., hard drive), wrote a definition to explain it to the class, and compiled these into a booklet.

In the few years since *A Statement on English for Australian Schools* (1994) was written, computer screens have become a major form of visual text in the media strand. Our students are learn-

ing about screen text by creating slide shows in Kid Pix Studio. After exploring the various Kid Pix modules, tools, and effects, students plan a narrative on a storyboard using either their own original story or adapting a traditional tale. They are encouraged to think carefully about narrative elements, visual design, use of colour, continuity, and choice of text to integrate with visual elements to convey the story. They then create their screens that are linked and presented as a slide show for others to watch. We find that this activity moves students away from reliance on paper and print and develops their visual creativity, memory, and understanding of narrative structure. While some students present straightforward illustrations of well-known tales, others use their ingenuity to create stories that allow them to use the graphic features of Kid Pix, such as the stamps, to good advantage.

As teacher-librarian, my main interest is in the incorporation of our technology in the information process, which class teachers and I work through with students in cooperative resource-based learning units. There are many opportunities for this to occur, as the following list shows. But at this point in the introduction of a new technology, we often decide to use information technology at only one stage of the unit in order to focus on acquiring and applying the skills needed.

INFORMATION PROCESS	INFORMATION TECHNOLOGY POSSIBILITIES
1. Defining and planning	▸ List ideas using word processing. ▸ Draw concept web using Claris Works Office. ▸ Create individual research proforma with questions and headings and space for notes.
2. Locating	▸ Use library computer keyword/ subject search.

	▸ Use reference CD-ROM keyword search(es) or browse using topic trees. ▸ Keyword search or browse Internet. ▸ Refine searches to reduce irrelevant hits.
3. Selecting and noting	▸ Use abstracts and numerical ratings to select the most useful Internet sites. ▸ Use WIN95 to swap between CD-ROM and Claris Works to make notes on screen and print. ▸ Use notepad or similar features of CD-ROM to make notes and print. ▸ Copy select CD-ROM text to word processor, edit, and print.
4. Organising	▸ Cut and paste notes on screen in a logical order. ▸ Add headings to notes if necessary.
5. Presenting	▸ Word process sentences/paragraphs on screen from notes. ▸ Word process handwritten notes or draft. ▸ Format work using fonts, sizes, layout, and graphics in Claris Works Office 4. ▸ Draw/paint original illustrations on screen. ▸ Print work for use on a poster, in a book, or as a pamphlet. ▸ Make pages into a slide show.

6. Evaluation	▸ Add ideas and comments to work on screen using italics to show reflections.

This list is not exhaustive, and neither would we expect all possibilities to be used in one unit. While some of these uses of information technology are familiar (e.g., using the library catalogue and basic word processing), others need to be taught explicitly as skills before students will be able to use them effectively in units (e.g., note taking on screen from CD-ROM). Our use of the Internet is very teacher directed and guided so that students learning search techniques can gain some useful information in a reasonable time.

Units on Australian explorers (Year 5) and the Australian desert (Year 6) illustrate how information technology has been used as part of the information process.

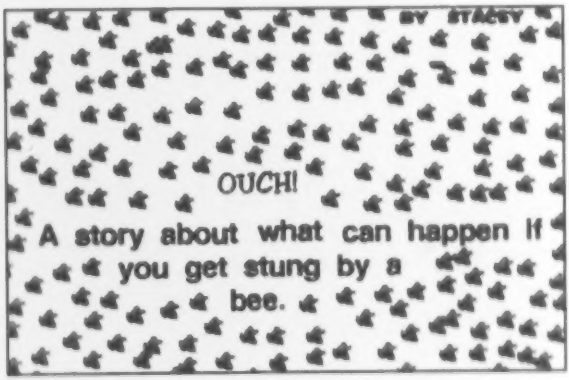
After providing an introduction and historical background by studying sea exploration as a whole class, the Year 5 students chose an inland explorer to research individually and used library books and picture sets (with text) as information sources. They read, made notes with pencil and paper, and organised their notes using numbering and colours. Their drafts were written on paper, jointly edited, and discussed in preparation for word processing. For the presentation step of the process, their teacher asked them to devise an interesting way of presenting their material (not just an A4 printout) and to format their word-processed material appropriately. Posters, newspapers, and dialogues were some of the formats chosen. Skills, which we then taught them as they word processed, included the following:

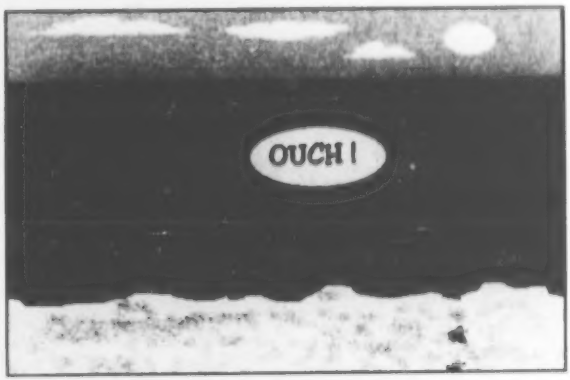
- use of invisibles to help setting out,
- use of columns for a newspaper,
- use of larger font size for posters,
- choice of legible and attractive font, and

- use of larger size and frames for headings.

Peer teaching proved very effective: As soon as one student had mastered a new skill, he or she was eager to teach others so the workload for the teachers was reduced considerably.

The Year 6 class undertook individual research on aspects of the Australian desert as part of an integrated language-science-social science unit. They had gained considerable background knowledge before selecting topics such as mining, Uluru, Alice Springs, abo-





SIR DOUGLAS MAWSON

Douglas Mawson was born in Yorkshire, England in 1882. In 1884 he and his family migrated to Sydney. When he grew up he became a scientist and geologist. He is noted all over the world for his exploration of Antarctica and the brave and clever deeds he performed there.

During his life he was constantly developing a good understanding and knowledge of the earth's natural resources. This knowledge was useful for the development of Australia.

FIRST EXPEDITION 1907–1909

Mawson and 2 other men climbed Mt Erebus, which was 4733 m high.

SECOND EXPEDITION 1911–1914

At the age of 26, Douglas Mawson organised his own party to go and explore the Antarctic with him. This was the first Australian Antarctic Expedition led by an Australian. The party left Hobart in December, 1911.

Arriving at the start of an Antarctic summer, Mawson and his 2 companions Ninnis and Mertz made good use of the 24 hour sunlight, as they had to prepare themselves for the harsh and bitter winter they had to survive through. Sleeping conditions were cramped and basic. Outside their shelter the men had to face blinding blizzards, freezing dangers, belligerent leopard seals and bottomless crevasses.

The journey many remember South Australian Douglas Mawson for, began on November the 10th, 1912. On that very day Mawson, Ninnis and Mertz began the Far Eastern Sledge journey, one of the many trips made from the main base. The plan was to trek the polar plateau for about 500 km and then return to the main base, collecting data useful to scientific research, such as rock samples, and making scientific observations. Since they had no idea about the direction or area this continent consisted of, the men relied on navigation by the sun and stars. Unfortunately tragedy struck on December 14th 1912. Near the point they were to turn back, Ninnis plunged down a crevasse with his sledge and dog team, taking the tent and most of the food with him. So Mawson and Mertz had to make a rough tent and kill the dogs for food.

WHY STURT'S EXPEDITIONS WERE IMPORTANT

Sturt found out what happened to rivers flowing westward. Smaller streams flowed into the Murray and the Murray emptied its waters into the Southern Ocean.

Sturt discovered that the Murray was a fine large river which boats could sail on.

Sturt discovered much good land and gave a good account of the country near Lake Alexandrina that plans were soon made for settlement in South Australia.

rigines, aboriginal art, mammals, plants, reptiles, and birds; in their individual investigation, we asked them to focus on effects of and adaptations to the desert environment. Locating relevant information required them to link the topic with the Australian desert and was thus quite challenging; students realised the limitations of *Encarta* and *World Book Encyclopedia* for Australian subjects.

Technology was used in this unit primarily as one of a wide range of information sources to be used alongside others:

BEST COPY AVAILABLE

- nonfiction books,
- print encyclopedias,
- magazines (*National Geographic*, *Australian Geographic*),
- tourist brochures and pamphlets requested by telephone,
- class visit to aboriginal art gallery, and
- picture sets about aboriginal art and culture,
- CD-ROMs:
  Webster's Encyclopedia of Australia
  Webster's Encyclopedia of Nature
  Fauna Australis
  Encarta
- Internet sites:
  Art: Aboriginal Art and Culture Centre
  http://aboriginalart.com.au/

  Ecology: Refugia for Biological Diversity in Arid and Semi-Arid Australia
  http://kaos.erin.gov.au/life/general_info/biodivser_4/bio_con.html

  Mining: A History of Mining in the Northern Territory
  http://www.dme.nt.gov.au/library/mine_history.html

During lessons involving locating, selecting, and noting information, the class teacher worked with students using print sources, while I worked with students using CD-ROM and the Internet; extra individual lessons were needed for the latter. Students presented their work in the form of a poster to support a talk to the class. While some used computers for this, it was not a focus for the unit.

At St. George College, the staff and students have progressed some way along the learning curve of information technology. We are encouraged by the intrinsic interest and excitement that

the software generates and a sense of satisfaction at our increasing mastery of the major technology of our time.

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